Influence of Home Environment on Cognitive Development of children in the age group 6-8 years of age

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INTRODUCTION

For any child, major dimensions of development that are of utmost significance are physical status, cognitive growth and emotional and behavioural development. Of these dimensions, cognitive growth has been an important area of research.

Cognition is a general term that have been used to designate all processes involved in knowing and includes perception, attention, memory, imagery, language functions, developmental processes, problem solving and the areas of Artificial Intelligence. Human cognition is an active process and individuals are constantly acquiring, updating, and modifying knowledge. Cognitive development is therefore a highly important yet gradual process for individual development and cognitive development is the growth in children's ways of thinking about and interacting with their environment.

Outcomes on each of these dimensions are determined by an interaction between factors intrinsic to the child and the environment in which he or she develops. These factors are most often mutually dependent (for example, physical illness and emotional malaise, Burke *et al* 1990). The resulting network of influences within the child and the environment is thus clearly complex.

While the nature-nurture controversy has been raging from a long time, most developmental psychologists now believe that, regardless of genetic, biological, or constitutional factors that may be involved, home and family social-environmental conditions play a significant causal role in development. Despite some occasional waxing and waning, the general commitment to this view has progressively increased over the years. Differences in cognitive development have been found to be influenced significantly by differences in the quality of cognitive stimulation in the child's environment. Large differences have been noticed in the cognitive abilities of children raised by parents who are concerned about their child's cognitive development and have knowledge about how to

maximize the potential versus children raised in homes where parents are unaware that they can influence their children's cognitive development These differences have been found to correlate with educational level, ethnicity, income, occupation of parents, etc (Goduka et al, 1992, Mehta, 1992, Bardouille et al, 1986, Basavanna & Ujwalavani, 1984, Hill, 1983, Kelly & Worell, 1977, Crandall & Battle, 1970)

Cognitive outcome is thus influenced both by genetic endowment and by an interactive environment, which may or may not respond to the child's needs It is generally the same parents who provide the genetic endowment who also supply the external conditions, including the nutrition, stimulation and affection necessary for development Cognitive outcome consequently reflects both direct and indirect parental influences (Plomin & Bergeman ,1991)

Psychosocial deprivation resulting in an non organic failure to thrive has been reported from the time of Spitz's (1945) classic study, and Fried and Meyer's (1948) study on early childhood development in institutions More recent investigations have revealed that the dyadic nature of parent-child interactions plays an important role in developmental cognitive delay Although more robust than language or socio-emotional development, general cognitive growth is encouraged by contingent responsive interaction which gives the child specific feedback and information Ramey, Farran and Campbell (1979) found that among the behaviours which correlated with early cognitive development, were the amount of mother and child interactions, physical contact, mother talking, maternal involvement and an absence of punishment and negativity

The correlation of intelligence with environmental conditions has been studied for several decades now Until recently, the nature nurture issue was almost synonymous with discussions of the role of home and family environment in cognitive development of children Although the correlations between the measured intelligence of adopted children and that of their biological and adoptive parents generally provide strong support for a significant genetic influence, it is the "higher- than-expected IQ scores of adopted children"(Sines, 1988 ,p 15) that has received most attention and has been cited as evidence of the causal influence of social environment on children's

intellectual development Family socioeconomic status (SES) has been a major environmental factor found to be significantly related to children's scores on measures of cognitive ability Significant correlations between children's tested intelligence and the SES of their families have been reported for over 50 years and the magnitude of that relation does not appear to have diminished during the period Two early reports of this relation were those of Leahy (1935) and Terman and Merrill (1937), both who found that children whose fathers' occupations were professional or managerial earned significantly higher IQ scores that did children whose fathers were casual or day labourers At about the same time, Neff (1938) reported a correlation of + 35 between children's cognitive functioning and parental SES More recently, Gottfried and Gottfried (1984) reported correlations of + 20 to + 41 between cognitive functioning and parental SES Other investigators (Bradley, Caldwell, & Elardo, 1977, Jordon, 1978) have reported similar moderate but significant correlations between these two variables Thus a robust finding has emerged between these two variables, though these correlations cannot as Sines (1988) remarks, be interpreted in an straightforward manner Two issues, viz , possible genetic confounding and the fact that SES is a distal measure of a variety of more specific proximal aspects of parent-child relationships have been implicated in the interpretations The primary components of all measures of SES are parental education and occupation, and both these are themselves related to parental intelligence which is under genetic control Thus family SES may relate to children's cognitive ability because parents' share their genetic makeup with their children as well as because intelligent parents construct more intellectually stimulating environments Moreover, as Yarrow, Rubenstein and Pedersen (1975) have stated "Social class membership *per se* does not effect the infant's development, rather it is the proximal variables, the kind of stimulation and pattern of care giving that are important" (p 12) SES is thus a distal variable that provides only a crude index of the more specific home and family environmental factors influencing cognitive development

Furthermore, the observed relations between children's intelligence and specific aspects of parent-child relationships are again questionable in terms of

direction. It is possible that intelligent parents engage in more, age-appropriate interactions with their children, and it is also possible that more alert, responsive and intelligent children stimulate their parents to engage in progressively more age-appropriate interactions. The extent to which parents are positively disposed to and accept the child is reflected in the amount of time they spend interacting with the child, the affectionate quality of those interactions and the degree to which they criticize or otherwise express hostility toward the child.

As Sines (1988) concludes, the literature reviewed provides "unequivocal evidence that several important aspects of children's home and family environment are significantly correlated with measured intelligence of children. The primary factors are SES with the correlation range from about .30 to about .50, family and parental pressure for achievement, $r = +.69$, parental acceptance of the child, $r = +.30$ to $+.50$, and finally on the basis of several adoption studies, being reared in a middle-class home by more intelligent and better educated parents" (p. 16). All these results seem to agree with the environmentalist contention.

Dodge, Pettit & Bates (1994) explored processes in socialization that might account for an observed relation between early SES and later child behavior problems. A representative sample of 513 children was followed from preschool to Grade 3. SES assessed in preschool significantly predicted teacher-rated externalizing problems and peer-rated aggressive behavior in all grades. SES was significantly negatively correlated with eight factors in the child's socialization and social context, including harsh discipline, lack of maternal warmth, exposure to aggressive adult models, maternal aggressive values, family life stressors, mother's lack of social support, peer group instability, and lack of cognitive stimulation. These factors, in turn, significantly predicted teacher-rated externalizing problems and peer nominated aggression.

The association between parent's behaviour and children's cognitive development is thus at the meeting place of several prominent theories of psychological development and a range of complex methodological and conceptual issues. On the one hand there are theories which argue that the impetus of development is within the child and is largely unaffected by his or her

experience of social interaction On the other are the commonsense experience of parents and educators, and the body of neo-Vygotskian theory, which would see the child's development as profoundly affected by social interaction or even constituted by it

In the light of all this evidence, rejecting the role of nurture in cognitive development would be dangerous It would be better to agree with Anastasi (1958) and Wachs (1984) in contending that, as we have ample evidence of the causal role of the social environment, we should get on with a search for answers to the more important and really interesting questions How, and to what degree, do which aspects of home and family environments influence which patterns of behaviour in children? In answer to this, the present study aims to determine, more specifically, the influence of home environment on the cognitive development of children in the age group of 6-8 years

Most studies on factors influencing cognitive development have concentrated on infants and preschoolers Several educational organizations and the popular press have argued for the importance of enhancing children's cognitive development between birth and age 3 These advocates often cite "new research in neuroscience" to support their position, although the research they typically cite is not new However evidence does not support a selective focus on birth to age 3 While there is no question that experience and stimulation play an important role during this period, researchers and policy-makers need to consider the importance of learning throughout development

The motive to study children aged 0 to 3 emanates from research on brain development, which indicates that both animals' and children's brains overproduce the synapses that interconnect neurons, then "prune" these synapses Researchers theorize that, as the brain integrates and consolidates early experiences, this "synaptic pruning, which decreases the total number of synapses, leaves behind an optimally efficient neural network

However research on the frontal cortex, a region of the brain that is involved in higher cognitive functions has shown that the peak number of synapses occurs later in development—between ages 4 and 6—and that pruning appears to

continue until adolescence These findings argue against emphasizing only the first three years of life, at the expense of later ages

Similarly, language learning studies suggest a longer window for many aspects of language development Studies of language learning in brain-damaged individuals and those learning American Sign Language and a second language, suggest a slowly closing window for higher order cognitive aspects of language acquisition, with no sharp transition at the end of the third year While many aspects of language become increasingly rigid between age 6 and puberty, others, such as vocabulary, seem to remain plastic indefinitely

Other research documents the importance of maintaining a rich environment for children older than age 3 Research on housing animals in "complex environments" illustrates the plasticity of the brain in later development and adulthood It has been found that rats reared in groups in large toy-filled cages that give them opportunities for exploration and play have more synapses per nerve cell and are better at learning than rats reared in barren laboratory cages The toy-filled cages approximate the normal rat's environment, while the simple cages constitute deprivation While these effects occur more readily in younger animals, they also occur in adult and even "middle aged" rats The ability to recover from deprivation later in life suggests that while learning may take new forms and abandon old forms across the life-span, learning-associated brain plasticity is a life-long process A human parallel may be educational intervention programs for children over age 3 Examples of preschool and school interventions that have substantial and lasting impact on education and life-success measures in disadvantaged populations have been reported

Few would deny that experiences from birth to age 3 are critically important to brain and cognitive development This period of development profoundly affects fundamental aspects of sensory, cognitive and language development and important aspects of attachment and emotional development But cognitive scientists and educational researchers have made enormous gains in understanding later cognitive development and its educational implications To focus upon the first three years and thereby downplay later years is not warranted, by either human behavioral or neuroscience research This study

therefore aims at studying children between 6-8 years of age (i e in primary school)

To therefore summarize,

- Cognitive development is an area where the environment plays a major role Thus development is a life-long process and does not stop at the age of three
- Intervention can help in fostering and enhancing this growth and development
- children can develop their cognitive skills best in an environment which is conducive to a variety of opportunities to engage in hands-on activities and games involving matching, grouping, and classifying Thus cognitive stimulation plays an important role in development and the home is a place where this can be easily provided

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Review of relevant literature

Theoretical Foundations

The three dominant twentieth-century theoretical propositions on cognitive development were postulated by Jean Piaget (1970) in his cognitive developmental stage theory, Lev Semanovich Vygotsky's (1934/1986) in his sociocultural theory and in the information processing approach. Of these, the most widely used theory to explain and understand cognitive development is the one postulated by Piaget.

Swiss psychologist, Jean Piaget, studied young children at various ages to try to determine how they 'grow up' mentally. He found that children pass through definable stages in their growth, and described the characteristics of each level. Though each child is an individual, psychologists have found that all children, regardless of economic status, language, race, or culture, pass through similar stages of cognitive development. Age guidelines are only approximate, the rate may not be constant (a child can have 'growth spurts' mentally as well as physically) but children cannot be forced or 'taught' to think at a higher level than they are ready for. Growth comes through experience and interaction with the world around them.

In Piaget's model (1970), cognitive growth is characterised in terms of the level of abstract representation, or thinking style, of which the child is capable. Children develop gradually from a very physical, concrete way of thinking, to a mature use of abstract concepts and logical thought processes. Children in the age group of 6-8 (the sample for this study) are according to Piaget, likely to fall in any one of two stages.

Children, ages two through seven tend to be in what Piaget terms the ***'pre-operational' stage***. They are beginning to develop language skills, and are able to use spoken words and simple pictures to represent things that aren't actually present. Their thoughts are guided by what they perceive - what 'seems to be' - rather than by reasoning or adult logic. This results in some characteristic ways of

understanding information, and some unique problem-solving approaches These ideas take many years to mature In fact, children don't develop really adult thinking styles until twelve or beyond

The young child does not understand that, although the appearance of something may change, some attributes can stay the same He cannot focus on more than one attribute at a time He cannot differentiate between partial and total change In addition, if he receives conflicting information, he will simply 'block out' one concept or the other The ability for *conservation* is thus lacking The classic example of this is the child's inability to see that, when you pour water from a short, fat container to a tall, narrow one, there is not more water The higher level of water in the tall, narrow container convinces the child that the amount of water has increased He is not able to understand that, while the height has increased, the width has decreased, and the amount has really stayed the same

These children do not have the ability to reverse a thought process and get back to the original idea, or to understand that two things may look different but are equal The child cannot 'go back and start from the beginning' He won't see that if 3+2=5, then 2+3=5 as well He is not able to put things 'back where he got them from' without some prompting

Young children also cannot understand a time line for events, particularly when they're in the past At the pre-operational stage, the child believes that the universe exists for and revolves around him This is not self-centeredness in an adult sense He does not consider the thoughts or needs of others because, as far as he knows, they are exactly the same as his For the same reason, he may not see why he must communicate his ideas or wants with others Gradually, through much experience, the child begins to see himself as a separate, unique person Only then can he put himself in another's place and see the world as others do.

Children also move gradually toward the understanding that words are only 'representations' For them, dreams are understood as real, external events that are acted out inside their heads Thoughts are material, promises are tangible

The next stage that Piaget postulated is the ***concrete operational*** stage, which spans the years from 7 to 11 Piaget viewed this stage as the major turning

point in cognitive development When children attain it, their thought begins to resemble that of adults Cognition in this stage differs form the previous one in being more flexible, logical, and organized Conservation or the ability to recognize that certain physical characteristics of objects remain the same even when their outward appearance change, develops during this stage These children are able to coordinate several important features of a task rather than center on only the perceptually dominant one - *decentration*, they can think through steps in a problem and then go backward - *reversibility*, they can flexibly group and regroup objects into hierarchies of classes and subclasses - *classification*, they are guided by an overall plan when arranging items in a series - *seriation*, they can conserve distance, understand the relations among distance, time and speed, and they can create organized cognitive maps of familiar objects Logical concepts are mastered gradually over the course of middle childhood Thus, because of their improved ability to conserve, classify, seriate, and deal with spatial concepts, school-age children are far more capable problem solvers than they were during pre school years But concrete operational thinking suffers from one important limitation Children think in an organized, logical fashion only when dealing with concrete information they can directly perceive Their mental operations work poorly when applied to abstract ideas - ones that are not directly apparent in the real world

Piaget awakened psychologists and educators to a view of children as active, knowledge seekers who underwent complex cognitive changes Though later research has revealed important shortcomings such as unclear operational definitions for many of his concepts, inaccuracies in his account of the time table of development, the role of experience in development and cross cultural differences, Piaget's theory has had a powerful influence on psychology and education, promoting discovery learning, sensitivity to children's readiness to learn, and acceptance of individual differences Indeed, Piaget has been rightly called the "Giant in the Nursery"

Another perspective on cognitive development that has been arousing much interest recently was the one offered by Lev Vygotsky This Russian psychologist was an active scholar in the 1920s and 1930s, when Piaget was formulating this

theory Vygotsky died at the age of 38, before his views were fully formulated, but his main theme was that *cognitive growth occurs in a socio-cultural context and evolves out the child's social interactions* According to Vygotsky's theory, cognitive development is shaped by the culture in which the child lives and by the types of problem-solving strategies taught to them by their parents and knowledgeable others Vygotsky proposed the concept of "*zone of proximal development*" – the difference between what the learner can accomplish independently and what he can do with the guidance and encouragement of a more skilled partner It is in this zone that sensitive instruction should be aimed and when cognitive growth can be fostered Thus, unlike Piaget, who proposed that children were independent seekers and explorers, Vygotsky strongly believed that children learn more sophisticated cognitive strategies from their interactions with more mature thinkers In sum, Vygotsky's sociocultural perspective stresses social influences on cognitive development, a fact that Piaget largely ignored

The third perspective that is influencing present day thinking on cognitive development is the information processing perspective It is a general approach in which the human mind is viewed as a complex, symbol-manipulating, information-processing system, through which information flows (Klahr, 1992) According to this approach, from presentation of the *input* to the senses to the behavioural responses as *output*, information is actively coded, transformed and organised A wide variety of information processing models exist, from the very specific to the most general which attempt to describe the human information processing system as a whole These general models are used as guides for asking questions about broad, age-related changes in cognitive development Like Piaget's theory, information processing also regards children as active, sense-making beings who modify their own thinking in response to the environmental demands But unlike Piaget, there is no stage wise development Rather, the thought processes studied - perception, attention, memory, thinking, problem-solving strategies, concept formation and categorisation, and language – are assumed to be similar at all ages but present to a lesser degree in children Thus quantitative rather than qualitative differences are emphasised in this approach

which views development as a continuous increase rather than as abrupt, stagewise changes

FACTORS INFLUENCING COGNITIVE DEVELOPMENT

Cognitive development is a largely exogenous process, and parent-child interaction is often a major source of cognitive stimulation There is a considerable amount of evidence that suggests an association between parents' behaviour and their children's cognitive development However there are many possible explanations for this association, including direct effects of parental teaching styles on the children's learning and motivation, differential social class practices and opportunities, genetic resemblance, and methodological artifacts A close and critical look at a wide range of research and of theory is necessary if the causal questions are to be clarified

Influence of home environment

The literature is replete with ways in which family variables facilitate the development of social and cognitive competence during the first few years of a child's life. Topics discussed have included the early parent-child relationship, disciplinary strategies, stimulation, parental encouragement of high-level cognitive strategies, the family system, and parental psychopathology as a risk factor

There is ample evidence that a variety of family environmental characteristics are significantly related to cognitive development Bradley *et al* (1994) examined caregiving environments for 243 premature, low birthweight infants living in poverty to determine effects on health and development The study found that children's health and development benefited significantly from six protective caregiving factors (1) increased parental responsiveness, (2) availability of toys and learning materials, (3) variety of stimulation, (4) parental acceptance, (5) safe play areas, and (6) less crowded homes, thus underlining the importance of home influences and stimulation on development

Williams and Gonzalez (1998) in their paper discuss the results of a study that explored the influence of two major external factors on children's potential

giftedness before the identification process was initiated The study involved 13 children (ages 4-6) and investigated parental perceptions of the influence of internal and/or external factors on their child's cognitive development, and whether these parental perceptions of the children's cognitive development were predictive of five home environmental factors (socioeconomic status, time parents spend with their child, parents' work hours, parents' educational level, and number of siblings in the home), and whether these same five home environmental factors were predictive of the child's performance on two cognitive development measures The study revealed that parents' perceptions about giftedness were present before the children were identified as gifted and were influenced primarily by one home environmental factor the level of the father's education Other factors in the home environment also were shown to have a secondary effect on children's cognitive abilities the mother's work hours, time parents spent with their child, and the number of siblings in the home The results indicate both indirect and direct relationships among the physical and psychological home environment, the parental perceptions about giftedness, and the child's cognitive abilities

Burchinal *et al* (1997) examined the various influences on the cognitive development of African-American children between 6 months and 8 years, and found that more optimal patterns of development were associated with intensive early educational child care, responsive home stimulation, and higher maternal IQ Childcare experiences were related to cognitive performance through enhancing infants' responsiveness to the environment Maternal IQ influenced cognitive development directly and indirectly

Portes, Cuentas and Zady, Madelon (1998) did a comparative study of parent-child interaction and its relation to children's intellectual achievement in an attempt to examine the question of cultural continuities in cognitive development Problem-solving behavior of fifth graders with their mothers from urban settings in Peru and the United States (N=64) was videotaped Critical problems in research linking family socialization to individual development were identified The results suggest that while interaction characteristics are related to children's intellectual achievement, that relation is moderated by context factors

that may operate differently in each culture. The findings have been discussed by the authors in terms of how literacy mediates parents' teaching styles in ways that are culture sensitive

In their study, Morisset *et al* (1995) examined sex differences in the association between environmental risk and language development, in a longitudinal study of 54 high-social risk families Measures of the environment included information about family stress and coping, opportunities for cognitive and linguistic stimulation, the nature of learning experiences, and the affective quality of the infant-mother relationship Despite apparently similar family conditions and early experiences, there were significant sex differences favoring girls on observational measures of spontaneous language production at 20 and 30 months of age For the group as a whole, however, sex differences on standardized tests at 24 and 36 months of age were nonsignificant In addition, relations between aspects of the learning environment and children's language performance differed for boys and girls

Fowler (1990) suggests how norms for language development can be advanced by improving the quality of early language stimulation, indicating possibilities for enhancing environmental control over talent development The evidence is drawn from a variety of sources that indicate how dependent verbal excellence is on experience, in both early and later development

Bradley et al (1986) conducted a longitudinal study of the influence of early home environment on the development of 174 infants (aged 4-36 months) They were subsequently assessed at different ages up to 11 years with one or more tests, which included the Bayley Scales of Infant Development, the Stanford-Binet Intelligence Test, the Science Research Associates Achievement Test battery, the Classroom Behavior Inventory, and the Home Observation for Measurement of the Environment Inventory (HOME) The results indicated moderate stability in the quality of home stimulation during infancy HOME scores differed according to race, socioeconomic status (SES), and family configuration Preschool HOME scores correlated significantly with measures of cognitive development during early childhood and the primary grades Achievement test scores were related to scores on a number of HOME subscales

Studying effect of family influence, Lowenthal, Landerholm and Augustyn (1994) investigated three aspects of ecological early childhood assessment family interviews, adult-child learning styles, and parent-child interactions The family interview was an assessment technique that could identify the strengths, concerns, and needs of the family A second type of assessment involved learning styles visual, auditory, and kinesthetic They found that children not instructed in their preferred style did not have the same chance of success as others Parent child interactions and modeling were found to determine their children's attitudes and behavior

Similar results of the importance of home environment have been reported by Gottfried and Gottfried (1986), who reviewed longitudinal research findings on the role of early home stimulation in children's development, noting evidence that cognitive development is more clearly related to the consistency of the home environment over time

Mahoney, Robinson and Powell (1992) contrasted the differences between the educational philosophy and procedures used in early childhood education and early childhood special education Early childhood education emphasizes child-directed instruction based on children's choices and interests and is embedded in children's play Early childhood special education emphasizes teacher-directed activities promoting the acquisition of specific developmental skills The research on parent-child interactions point to the potential benefits of early childhood education procedures by promoting cognitive, language, and social development

Black et al (1994) examined differences in several developmental indices of competence among 102 low-income, inner-city, predominantly African American children with non-organic failure to thrive (NOFTT), and a comparison group of 67 children with adequate growth matched on age, gender, race, and socio-economic status Parents were categorised into one of three groups (nurturing, authoritarian, and neglecting) based on observations Parents of children with NOFTT were found to be less nurturing and more neglecting than parents of the comparison group of children Associations between parenting style and children's social-cognitive development were similar across groups The

researchers also report that children of nurturing patents consistently demonstrated better social-cognitive development

Strand's (1988) studied the role of parental and home influences on the cognitive development on children Fifty-nine Mexican-American families, each with a child between age 5 and 9, participated in the study to determine whether paternal proximal behaviours related to child ability and achievement. (Strand, 1988) Proximal behaviours studied were (1) teaching strategies, (2) language in literacy related activities, (3) involvement level in childcare, and (4) select gender-specific behaviours Additionally, the study examined associations between acculturation level and proximal paternal behaviours Instruments used were the Parent Background Form (PBF), the Cognitive Home Environment Scale (CHES), the Peabody Picture Vocabulary Test (PPVT), and a revised version of the Maternal Teaching Observation Technique (MTOT) In addition, primary teachers rated children for classroom performance and academic potential To study father-child interactions, research assistants videotaped fathers teaching their children on a model assembly task Interviews with mothers identified childcare responsibilities in the home Results showed that fathers who incorporated independence training in their teaching approach and used English in literacy-related activities had higher rated children No significant differences were found in involvement level with respect to father's level of acculturation or in teaching approaches with respect to gender Among the implications of the study are the following: (1) future research should account for paternal as well as maternal influences when assessing home environment variables, (2) teaching methods in school should complement paternal methods, and (3) parental behaviors which promote child self-efficacy should be encouraged

Bradley et al (1994) report a study which represented another look at the relationship between the HOME inventory and income, using data from the Infant Health and Development Program, a multisite, longitudinal study of low-birth-weight preterm infants The results of the relationship between HOME scores and four child characteristics (cognitive development, growth, maladaptive behaviour, and social competence) indicated that the quality of the home

environment, as measured by the HOME inventory was related to children's development

In concluding, there have also been numerous studies that have documented the beneficial effects of parental school involvement. There is consistent implication that parental involvement in children's school experiences is causally linked to student academic performance (Ciriello, 1991, Epstein, 1987, Henderson, 1987) Johnson (1994) in an attempt to explore the relationship between family characteristics and the level of that involvement however reported that other factors and not parental school involvement alone may confound such findings She postulated that family characteristics such as income, parental education, cultural/linguistic variations, family structure and child care arrangements were related to parental school involvement She found that parental education was the best single predictor of parent school involvement, thus parents who themselves value formal schooling manifest that value in their children

Finally, Bhargava (1998) analysed the scores on cognitive tests and school examinations of approximately 110 Kenyan children aged 6-9 years and formulated a model He found that certain measures of biological development and grade level were important predictors of scores on higher order cognitive tests Household socioeconomic status is also positively associated with cognitive scores

Maternal influences

Maternal over-control, restrictiveness and intrusive directiveness have been found to correlate strongly with non-verbal aspects of the development of intelligence (Olson, Bates & Bayles, 1984) Research has shown that unsupportive and restrictive parents may impede sensorimotor learning in their child, and in the longer term, impair motivational development and the mastery of non verbal skills (Vyt, 1993)

In other studies, Berlin *et al* (1995) examined 2 sets of measures of parenting behavior (PB) in mothers of low birthweight, premature infants, using the Infant Health and Development Program Correlations between the HOME (Home

Observation for Measurement of the Environment) Warmth subscale and the Supportive Presence scale (emotional scales), and between the HOME Learning subscale and the Quality of Assistance scale (cognitive stimulation scales) were investigated in mothers of 204 White and 282 Black infants The individual and collective predictive strengths of each PB measure were examined vis-a-vis two child outcomes children's behavior problems and children's receptive language abilities up through 36 months of age The study reported moderate correlations between the two emotional support scales and between the two cognitive stimulation scales

In another study, Brody and Flor (1998) tested a model linking maternal/family characteristics to child cognitive and psychosocial competence in African-American 6- to 9-year olds in rural single-mother-headed households They found that maternal education, religiosity, and financial resources were linked with parenting style, mother-child relationship, and maternal school involvement Proximal variables were linked to children's cognitive competence and social competence

Khandke, Pollitt and Gorman (1997, 1999) in their study examined the contribution of maternal education to variations in child outcomes from birth to 7 years of age The sample for this study consisted of 266 children and their mothers, drawn from four rural communities in eastern Guatemala, who had participated in a longitudinal nutritional supplementation study Their study of the role of maternal literacy on cognitive development in children showed that there is growing evidence supporting the powerful role that maternal education plays in child growth and cognitive development in developing countries It was hypothesized that mothers who had more than 3-4 years of education and a greater probability of being literate would have offspring with reduced incidence of illness, improved growth, and improved performance on cognitive tests Data showed the influence of mother's education and socioeconomic status on children's performance on cognitive tests Mothers with 4 or more years of education had children who performed significantly better on a preschool battery administered at ages 5 and 7 than mothers with fewer years of education These results add to the growing evidence of the strong positive association between

mother's education and child outcomes in developing countries The data strongly support the argument for investment in basic primary education for females in lower income countries Findings indicated that after controlling for socioeconomic status, maternal literacy significantly mediated the relationship between maternal education and cognitive tests at 5 and 6 years of age

Olsen, Bates and Kaskie (1992) examined the association between early caregiving and children's cognitive competence at school age In their study they measured caregiver-child interactions when children were ages 6, 13, and 24 months and again at age 6 years, and related this to assessments of cognitive competence at ages 6 (n = 79) and 8 years (n = 85) Children's temperament and developmental status were also assessed during the first two years and examined as potential mediational links in relations between early caregiving and later competence Instruments included the Home Observation for Measurement of the Environment, the Infant Characteristics Questionnaire, Bayley Mental State of Infant Development, and a maternal perceptions questionnaire Two major dimensions of maternal behavior, nonrestrictiveness and verbal stimulation, were significant predictors of children's later cognitive competence These relations were not artifacts of variations in family SES, children's early temperament, or developmental status

Pagan and Dore (1993) compared the play interactions of 17 neglecting mothers and 10 non- neglecting mothers with their toddlers and preschool-age children Mothers were interviewed for 45 minutes before beginning the play observation Findings demonstrated that neglecting mothers were less responsive to their children during play interactions than were non- neglecting mothers Results also suggested that neglecting mothers were less developmentally appropriate in play interactions with their children and they had difficulty interacting with them Because of the importance of mother-child play to the formation of secure attachments in infancy and the significance of such attachment in facilitating positive social, emotional, and cognitive functioning in childhood, the authors suggest that early childhood intervention focus on sensitizing neglecting mothers to their children's development

Campbell (1990) tried to find out the parental beliefs and values related to family risk, educational intervention and child academic competence. The primary goals of this study were to determine (1) whether a child centered educational preschool program and/or a parent-centered early elementary educational intervention program for disadvantaged children had effects on the child rearing beliefs and values of parents, and (2) whether parents' child rearing beliefs and educational values were related to children's academic achievements in early elementary school. Subjects were 83 low-income parents whose children were judged to be at risk for academic problems associated with mild mental retardation. Children from the at-risk subjects' kindergarten classes were randomly chosen to provide a local population comparison group. The preschool intervention consisted of a systematic program that provided intellectual stimulation for infants and preschoolers in a day care setting. The school-age intervention consisted of supplementary learning activities that parents could implement with their children and that were delivered in biweekly home visits of a home-school resource teacher. Findings indicated that mothers of at-risk children in the preschool intervention group scored lower than other mothers on traditional beliefs. Such parental beliefs were negatively correlated with children's achievement in reading. Parents of at-risk children differed from control group parents in beliefs and values. The study concludes that maternal IQ and authoritarian beliefs may both be implicated in differences in parenting style, which impact children's language development and eventual literacy.

Aboud and Alemu (1995) studied the effect of maternal responsiveness on mental development of Ethiopian children. Forty children between the ages of 16 to 42 months and their mothers living in an Ethiopian rural village participated in the study. The results revealed that the rate of a mother's verbal response to the child positively predicted the child's verbal score. In contrast, the mother's spontaneously initiated motor actions towards the child correlated negatively with the child's performance score. Thus maternal behaviour had an influence on the child's development as measured on the Bayley Scale of Mental Development. Similar results of the effects of mother-child interactions have also been reported by Puckering et al (1995). In their study, a whole population inner-

city survey identified twenty-three stunted, otherwise healthy, children with persistently poor growth from infancy to four years Their cognitive development was significantly retarded relative to a matched comparison group Unstructured home observations which assessed verbal and non-verbal mother-child interactions revealed that cognitive performance of the child was correlated with the quality of stimulation

Language development is promoted by the same sort of environment as cognitive growth in general Here, a mature speaker provides conversation, which presents the child with material that is just at the leading edge of his/her competence (Baker & Nelson, 1984) Ideas of global stimulation have proved unhelpful, it is personalized, contingent interaction and encouragement, which is most pertinent to the acquisition of language and general cognitive development (Jennings & Connors, 1989, Rice, 1989) For this reason, children benefit from the rich individual attention provided when they are read to, or read for their parents (Tizard, Schofield, & Hewison, 1982) Though exclusive dyadic interaction with adults is a peculiarly Western middle class notion of normal development, children from non-Western cultures acquire language competently in multispeaker contexts (Barton & Tomasello, 1991)

Blau-Francine and Grossberg (1990) studied the effect of maternal employment on children's cognitive development This study used a sample of 3- and 4-year-old children of female respondents from the 1986 National Longitudinal Surveys Youth Cohort to analyse the relationship between maternal labour supply and children's cognitive development Findings indicated that the impact of maternal labour supply depended on when the labour occurred Maternal employment was found to have a negative impact when it occurred during the first year of the child's life and a potentially offsetting positive effect when it occurred during the second and subsequent years Although there was some evidence that boys were more sensitive to maternal labour supply than girls, the gender difference was not significant The negative first-year effect was not mitigated to any great extent by the increased maternal income that accompanied it However, the increase in maternal

income did appear to play an important role in producing a positive effect in the second and later years.

Paternal influences

Yogman, Kindlon and Earls (1995) assessed the independent effect of father involvement on intellectual and behavioral outcomes of 985 low birth weight preterm infants followed longitudinally from birth to 3 years to evaluate the efficacy of comprehensive early intervention in reducing developmental and health problems of such infants. Most fathers were found to play a meaningful role as play partner with their high-risk infants. Approximately 75% of fathers were reported to play with the baby every day at 12 (peak), 24, and 36 months. Fathers who were Black, younger, had teenage mothers as companions, or were from low-income families were less involved with their infants. Mean IQ for the high-involvement subgroup was 6 points higher than for the low-involvement group even after adjusting for family income, neonatal health, treatment group status, and paternal age.

In summary, optimum stimulation is likely to be provided by concerned parents who are prepared to listen to their children and in turn supply them with information and conversation. The ideal parent would be sensitive to the child's needs in intimate interaction, and would foster warm affectionate attachment.

Effect of media

Zoban (1989) examined the importance of oral storytelling for children. The study focused on: (1) the purpose and benefits of storytelling, (2) the importance of storytelling in the early childhood setting, (3) development of language skills, including oral communication, nonverbal communication, and mastery over story material and story language, (4) the fostering of listening skills, (5) stimulation of imagination and creativity, and (6) development of social and other personal skills. She concluded that oral story telling plays an important part in the development of children's cognitive/language abilities.

Klein (1992) studied the role of humorous stories in fostering children's development She reports that storybook humor promotes learning and supports children's social and emotional development Children's literature employs comic incongruity as a source of stimulation, cognitive exercise, or means of relieving stress Looking at picture books is intrinsically enjoyable to young children Children like storybooks that help them experience a sense of mastery over events in their daily lives, such as toilet training, separation anxiety, and bedtime Children learn about language structure and usage as they interact with books and adults in meaningful ways Behavioral incongruity that involves breaking social rules is appealing to young children who struggle with conformity Thus reading influences cognitive development in all aspects

Culture

Le Vine *et al* (1994) in their book "Child Care and Culture" examined parenthood, infancy, and early childhood in an African community, raising provocative questions about "normal" child care Comparing the Gusii people of Kenya with the American white middle class, the authors showed how divergent cultural priorities create differing conditions for early childhood development Gusii mothers, who bear 10 children on average, focus on goals of survival during infancy and compliance during early childhood, following a cultural model of maternal behavior for achieving these goals Their practices were successful in a local context but diverge sharply from those considered normal or optimal in North America and Europe, especially in terms of cognitive stimulation, social engagement, emotional arousal, verbal responsiveness, and emotional support for exploration and conversation Combining the perspectives of social anthropology, pediatrics, and developmental psychology, the authors demonstrated how childcare customs could be responsive to varied socioeconomic, demographic, and cultural conditions without inflicting harm on children

Bornstein *et al* (1990) conducted home observations of maternal responsiveness in a longitudinal analysis of 55 Japanese mothers and their 4-5 month old infants Cognitive performance was tested in children at 1 5 and 2 5

years of age, using an infant intelligence test and the Peabody Picture Vocabulary Test. High levels of maternal responsiveness were found, as well as a relative independence of different forms of maternal responsiveness and of maternal responsiveness in relation to other forms of maternal activity. Maternal responsiveness was found to predict children's later cognitive performance, even when maternal noncontingent stimulation was statistically controlled for. Finally, Maternal responsiveness varied with the context of mothers' interactions, and mothers tended to reward their infants' bids to them relative to bids to properties, objects, or events.

In a critical review of environmental influences on cognitive development, Scholnick (1986) suggested that MacDonald's (1986) claim that intellectual development is characterized by waning sensitivity to environmental stimulation that can only be compensated by increasingly intense input rests on 5 controversial assumptions. (1) Only the environment stimulates intellectual growth and accounts for individual differences, (2) the influence is unidirectional, (3) intelligence is a single entity, and all forms of environmental input are qualitatively equivalent, (4) the only constraints on sensitivity are the age of the organism and the ecological validity of the input, and (5) early, intense stimulation is generally the most effective. She concludes that such assumptions may simplify the understanding of the intricate interplay of individuals and their environments during the course of intellectual development and lead to use of inappropriate evidence for sensitive periods.

Effects of Intervention programmes

In the belief that nurture does play a role in cognitive development, several studies have been done to improve cognitive development in young children, using different intervention strategies.

Child development specialists and findings of developmental research on the effectiveness of very early interventions indicate that when early interventions are made, their outcomes are impressive in terms of academic and social gains. Realism dictates that attempts to radically improve children's health, education,

and overall well-being must start as early as possible There is a widespread perception that the education system has failed The crux of the problem is often our failure to do enough for children, early enough to make a lasting difference in their lives Too little too late seems to be the golden rule To be successful, intervention attempts need to involve parents who often, due to ignorance, do an inadequate job of nurturing and stimulating their children in the critical years of preschool and primary school Thus home intervention becomes an issue of vital concern

Paul (1992) provides an important perspective for understanding the past 20 years of early childhood interventions Based on an extensive review, she concluded (a) that positive outcomes have occurred when evidence of institutional change was in conjunction with individual change, and (b) that need exists to bridge segmented components of this society's social structure (e g, school and home) She believes that progress in cognitive skills development can be made with children from low-income minority families via early intervention programs and insists, however, that anthropological research findings can assist in designing more effective programs

Most research on the long-term outcomes of early enrichment programs for low-income children suggests that the effects of Head Start participation and similar experiences are to help narrow the gap between academic achievement of low-income and higher-income children The failure of children from low-income families to excel in public schools, in U S A has been attributed to their tendency to develop skills more appropriate to a different cultural setting than what fits within an academic setting Poor children experience different kinds of verbal interactions with adults and generally less academic, intellectual stimulation in their homes Thus, when entering school, low-income children bring with them different backgrounds from middle-class children, resulting in differing ways of relating to adult authority figures in school settings Harper (1995) conducted research under the premise that the degree to which children are either adult- or peer-oriented is a critical factor for school success Preschool children who spend more time with adult caregivers develop expectations of

adults as valuable resources and also cultivate greater skill in using adults as resources The approach suggested includes an emphasis on the role of adults, especially teachers, as useful resources, facilitators of interesting activities, and as a means of comfort and assistance for children

Noting current brain development research, Schiller (1999) offers simple, straightforward ways to boost children's brain power with active exploration, repetition, sensory exploration, laughter, and more, and explains how parents can give their children the best foundation for future learning Some of the different strategies that have been studied relate to neurological processes and choices, mind and body cycles, emotions, multiple intelligences and problem solving

Noting children's inclination for things mathematical, Frombolutt et al (1999) have explored the use of home activities which parents can use to challenge their children's minds and to help parents ask their children questions that will get them thinking The activities require no special equipment or detailed planning, and can be incorporated into children's daily routines The activities are intended to promote the learning and development of the "whole child,' and build language skills, thinking and problem-solving abilities, social skills, large and small motor development, and general knowledge, as well as mathematics skills

Lindsey (1999) in her paper discusses findings providing evidence for the significance of early childhood for brain development, highlighting pivotal discoveries that should guide care and education of the young The paper reiterates the stages of brain wiring, critical periods, and the role of environment in brain development and makes recommendations for broad policy changes to help parents and practitioners put into practice recent neuroscience findings

Ben-Hur (1998) in her study found that children lacking sufficient mediated learning experiences (MLEs) are ill-prepared to handle the cognitive challenges confronting them at school and cannot benefit even from hands-on learning experiences Reuven Feuerstein's theory of MLE holds that our cognitive abilities are modifiable, that we can change the course of a child's early cognitive development MLE's defining characteristics are intentionality and reciprocity, transcendence, and meaning

Soto (1994) worked with four preschool children with mental disabilities to increase their cognitive abilities through the use of computer-based instruction and use of manipulative materials The study also sought to improve the children's social-emotional development and self-esteem The developmental levels of the students were determined, and appropriate cognitive objectives were chosen Concepts taught included shapes, colors, letters, and numbers Appropriate computer programs were selected to introduce the concepts and provide relevant practice, and manipulative activities were developed to provide tactile stimulation Children were also provided with opportunities to sort, match, identify, color, paint, paste, sing, and dance about the concepts The study revealed that the intervention programme successfully met its objectives

Brooks-Gunn *et al* (1994) in their study tried to evaluate the persistence of effects of an early childhood intervention that was provided to low-birth-weight premature infants On the basis of their results they concluded that early childhood intervention provided in the first three years of life had effects on heavier low-birth-weight premature infants' IQ and verbal performance at age 5 years

Quinn (1995) presents a case study of the work of severely deprived school-age children (aged 7-8 years) exposed to cognitive stimulation and methods of critical thinking The written work of these students showed that these children were generally capable of delighting in a much greater intensity of rigorous thought than that to which they were usually invited The study recommends that teachers can stimulate critical thinking through the following (1) arousing curiosity, (2) responding to first efforts with experience and questions, (3) nurturing an intellectual algorithm and developing the generality of its application, and (4) introducing the appropriate terminology that is the surface manifestation of these deep cognitive processes

Soewondo (1995) reports a study conducted in Indonesia, which examined the effectiveness of a training course given to mothers of children aged 12 to 24 months, on the rearing environment and consequently to the child's development The subjects were 69 mothers in the age range of 20-35 years The training, which lasted for 21 days, included training using the programme "Ibu

Maju Anak Hermutu" The results revealed that the rearing environment as well as the child's mental and psychomotor development improved, proving the efficacy of the intervention programme

In a study to find out the efficacy of intervention in increasing cognitive development, Lee (1993) evaluated the effectiveness of a developmental toddler educational care (DTEC) program designed to provide individualized care and to address socioemotional, physical, and cognitive development The Korean version of the Developmental Profile was used to assess development at the beginning of the program and at the end of 1 and 2 school years Experiment 1 assessed short-term effectiveness in cross-sectional comparisons for 3 groups of 2-4 year old children 14 DTEC participants, 14 subjects from another day care program, and 4 waiting-list controls Experiment 2 investigated the effects of DTEC after 1 and 2 years and studied subjects' home environments Sixteen, 26-59 months old children participated in the 1-yr study, 5 children participated in the 2-yr study The research reported that DTEC subjects gained in physical, social, and academic abilities after experience in the DTEC program Program families tended to provide almost the maximum level of stimulation for development of their children at home

In a study, Kohli (1990) evaluated the effectiveness of portage training (PRT) given to 120 developmentally delayed disadvantaged children (aged 1-6 yrs) The impact of duration of PRT was also studied It was found that PRT was significantly effective in improving skills in social, language, self-help, cognitive and motor areas of development and improvement of development quotient (DQ) in 3 different tests of intelligence The longer the duration of training, the greater were the gains in behavioral skills and DQs

Hemecke (1993) reviewed nine early family intervention outcome studies and found that this type of intervention did promote family development and that duration/intensity, comprehensiveness, and the amenability to intervention were likely to impact the extent and nature of that outcome Given the choice of a relationship intervention, it was argued that outcome variables associated with the development of the child's secure and separate self were more likely to

respond to such a home visiting intervention than such cognitive measures as IQ He further argued that as part of the strategy to define how process relates to outcome, the various intervention roles used had to be defined both theoretically and operationally

Klein and Alony (1993) in their study on immediate and sustained effects of maternal mediating behaviours on young children studied 68 low-SES women who were divided them into an experimental group and a control group They and their 4-yr-old children participated in a follow-up study of the impact of training mothers to optimize their infants' development through theory-driven mediational strategies The effects of these interventions on subjects were assessed 1 and 3 years following the intervention An increase in maternal mediation behaviors following the intervention was found in the experimental group and remained significant at the 3-year follow-up, children in the experimental group spontaneously named more things, expressed more excitement, asked more questions, and showed more rewarding behavior toward their mothers These subjects had higher scores on the Peabody Picture Vocabulary Test and scored higher on verbal abstract reasoning tasks than did the control group children Maternal mediation behaviors were significantly related to specific children's behaviors and cognitive outcome measures

Wasik, Ramey, Bryant and Sparling (1990) compared the efficacy of two intervention strategies Sixty five families with children at risk for cognitive difficulties (because of disadvantaged social or educational circumstances of children) were randomly assigned at the time of the child's birth to 1 of 3 groups 2 intervention and 1 control For the most intensive intervention group, family education was combined with a center-based educational day-care program, the less intensive intervention group received the home-based family education program only To assess the cognitive performance of children, the Bayley Scales of Infant Development were administered at 6, 12, and 18 months, the Stanford-Binet Intelligence Scale at 24, 36, and 48 months, and the McCarthy Scales of Children's Abilities at 30, 42, and 54 months 59 families completed the study On each test after the 6-months assessment, scores of children in the educational

day-care plus family support group were greater than those in the other two groups

Gilmore (1988) implemented a practicum designed to develop selected thinking skills in approximately 40 nursery school 3-year-olds The practicum was also intended to inform parents of practical techniques for fostering important thinking skills in their children Curriculum materials were developed to teach the thinking skills of comparison, classification, ordering, analogy, fluency, flexibility, elaboration, and originality Techniques, which were field-tested with the children, were used in the designing of a practical parent handbook for fostering critical thinking skills in the home The programme focused on the process of learning to think, the issue of what critical thinking was, the role of the brain in thinking and techniques that fostered thinking skills Practicum evaluation data indicated that standards of performance were met for each of the general goals. Children grew in thinking ability as reported by a group observation log A critical thinking checklist assessment showed global mean score growth

Padmini (1983) developed a programme for fostering cognitive development in first standard pupils Following the Piagetian model of cognitive development, this special activity programme was based on selected concepts and operations appropriate to the age level of first standard pupils Taken as a whole, the programme provided a wide range of cognitive ability oriented activities (for e g representation, spatial relations, temporal relations, weight, length etc) to foster or strengthen over all cognitive development in children aged 5 to 7 years Results revealed that the programme was highly effective in fostering cognitive development in boys and girls coming from different family and education backgrounds, and different social strata

Dunham, Kidwell and Portes (1988) examined the continuity of cognitive development from early childhood to early adolescence in light of mother adolescent interaction and demographic measures 54 mother-adolescent (ages 12-15 years) dyads, from a follow-up of an early-age antipoverty intervention, participated Social class, ethnicity, and gender balanced middle- and lower class control groups and an experimental group They found that there was a

continuity of cognitive development within each social class, in the absence of intervention Social-class and ethnic differences were mitigated for the lower-class treated group but reemerged over the decade following the intervention For the middle-class and treated lower class groups, a participatory style of mother-adolescent interaction was related to cognitive development and accounted for much of the power of demographic variables in the prediction of cognitive development

Clarke and Clarke (1989) reviewed research on the cognitive effects of early intervention with disadvantaged preschoolers They found that while early intervention typically yielded short-term advantages for children and their parents, after program termination, cognitive increments usually followed the law of diminishing returns unless the intervention set off a chain of ongoing, positive consequences Continuing interventions and maintenance of these changes was unlikely They concluded that familial factors (including unfolding genetic and psychosocial influences) were more important for long-term outcome than brief interventions themselves

Putting all these results together, the implication is clear - intervention, whether home based or school based, does bring about a change for the better in cognitive development Though early intervention is the best, development is continuous and children in primary schools can also benefit from the effects of intervention However, for the effects of intervention to be long lasting, the interventions should be planned keeping in mind the culture and sub culture for which it is designed, and longer duration of the intervention programme with follow-ups would be highly recommended

To conclude, research in biological, behavioral and clinical sciences has flourished over the past four decades These scientific efforts have produced an abundance of information regarding the nature, course, and determinants of human development, both normal and pathological At the same time, this increased understanding has facilitated advances in the design of techniques to prevent and treat medical and psychological disorders, and to correct educational deficiencies that frequently accompany such disorders However, there are many

children and adults around the world who have yet to benefit from these new developments and are deprived of more basic care Perhaps, in order to solve problems, in order to bring about change at all levels, we need to encourage cross-cultural exchange and work together, so that we learn from one another

3

PRESENT STUDY

Influence of various environmental factors on the development of cognitive abilities in the young school going child was the focus of this research Specifically, this study concentrated on the influence of home environment on the cognitive development of children in the age group of 6 - 8 years It was intended that some of the supportive environments that govern the development of specific cognitive skills namely attention, memory, language and thinking be identified In addition, the usefulness of an intervention programme aimed at facilitating cognitive development would also be evaluated

Objectives of the study.

- To identify the impacts of different environmental conditions on the cognitive development of children in the age group of 6 - 8 years There are different environmental conditions that are likely to influence the cognitive development of children of this age However, this study concentrated predominantly on home and school backgrounds

- To develop a package of intervention techniques that can help promote cognitive development

This research was concerned mainly with school going children and fell in the category of elementary education Though broadly and psychologically speaking, the term 'education' is not confined to the boundaries of the school environment, 'elementary education' is Hence the research dealt with children who were enrolled in some school

Method

Design

The study was done in three phases using an exploratory as well as a pre-post research design

First phase

- *Cognitive development* of children was measured using a battery of tests that assessed specific cognitive abilities as well as cognitive development as a whole
- Interviewing both the mother and father, through the use of a semi-structured interview format assessed effect of home influences
- School details such as class strength, ratio of boys/girls in the class, medium of instruction, type of school etc were collated to assess school influences

Second phase

- *An Intervention programme* was given to those children who appeared to be slower in their cognitive development when compared to their age counterparts Using the Mediational Intervention for Sensitizing Caregivers (MISC) developed by Dr Pnina Klein, this intervention aimed at turning adult-child interactions into enriching learning experiences for the child, using patterns within the existing child rearing practices

Third phase

- The effect of the intervention programme was studied using the pre-post design

First Phase

Sample

To obtain the sample for the main study, it was decided to divide Bangalore city into four zones - North, South, East and West and to ensure that all zones

were covered Within a zone, at least two schools were selected based on the following criteria

- It should be a co-educational school This ensured that sex differences could not be attributed to school environment
- It should cater to the S S C stream This was necessary as Government schools in Karnataka cater only to the State Board exam
- It should cater to the lower middle and middle class SES The lowest SES was not included because cognitive development is influenced by nutritional status and malnutrition was not a criterion in this study
- The school should not have a transport system to bring children to school This ensured that most of the children lived in that locality and therefore interviewing parents would be more feasible
- Last but not least, the management, principal and teachers had to be willing to co-operate in this research project

Based on the criteria spelt out, children studying in the 1st, 2nd and 3rd standards in schools offering the S S C course, in Bangalore North, South, East and West were contacted, and were administered the battery to assess cognitive development The following schools participated in the study

Table 3 1 Schools included in the study

School	*Medium of instruction*	*Number*
Anugraha	English	18
Auden	English	11
Bangalore Fort School	Kannada	35
Cauvery School	English	13
Kalasipalyam School	Kannada	11
Malleswaram Ladies English School	English	18
NCB	English	25
Noble English School	English	29
Saraswathi Sishu Vihar	Kannada	45
Saraswathi Vidya Mandir	English	35

To obtain the sample of children, a stratified random sampling technique was used. To do this, one section in each standard was randomly picked by the researcher (and not the Principal of the school or the class teacher as this has been found to lead to biases). Lists of the names of all children enrolled in that section along with their date of birth were compiled, sex wise. The names of all children whose age fell within ± 3 months of the desired age were retained and from this list, every third name was selected to be included in the sample.

The *Inclusion criteria* for selection of children were

- "normal" children i.e. not suffering from any psychological or physical disorder, or mental retardation
- staying with their parents or at least one parent, in some kind of regular home
- attending school for at least 20 days a month

The *Exclusion criterion* was

- children staying in hostels or residential schools

Thus in all, 240 children, belonging to both the sexes, from ages 6-8 and studying in government and private schools were tested and their parents (mothers = 231, fathers = 218) were interviewed. For some children, only one parent was interviewed because some of the families were single parent families. The causes ranged from widowhood, desertion and illness to transfer (when the spouse was not in Bangalore). Tables 1.2 through 1.8 give the sample details for the 6-, 7- and 8- year old children on the relevant demographic variables. Contingency coefficients and F ratios, calculated and reported are all non significant indicating that the groups were more or less homogeneous on these relevant demographic variables.

Table 3 2 Sample details

	6 years		7 years		8 years	
	Mean	S D	Mean	S D	Mean	S D
Father's Age	37.34	6 33	38 57	4 01	40 14	4 29
Mother's Age	31 05	6 25	32 59	4 88	33 43	4 71
Material prosperity	17 0	9 20	16 14	9 91	18 53	8 04

Table 3 3 Distribution of father's education for the three sub samples

Father's Education	6 years	7 years	8 years
Illiterate	9	3	5
Can read and write	5	7	4
Primary	6	2	7
Secondary	11	20	13
Matriculation	11	10	14
Post Matriculation	9	5	10
Graduation	18	16	9
Post graduation	3	5	6
Professional	3	4	3
Total	**75**	**72**	**71**

Contingency coefficient = 285, non-significant

Table 3 4 Distribution of father's occupation for the three sub samples

Father's Occupation	6 years	7 years	8 years
None	1	1	3
Unskilled	11	7	6
Skilled	14	12	12
Clerical	12	17	13
Business	19	12	15
Administrative	9	14	13
Professional	6	5	6
Any other	3	4	3
Total	**75**	**72**	**71**

Contingency coefficient = 21, non significant

Table 3 5 Distribution of mother's education for the three sub samples

Mother's Education	6	7	8
Illiterate	16	11	12
Can read and write	8	7	6
Primary	9	10	14
Secondary	9	15	15
Matriculation	13	13	9
Post Matriculation	7	6	14
Graduation	12	15	5
Post graduation	3	1	1
Professional	0	0	0
Total	77	78	76

Contingency coefficient = .256, non significant

Table 3 6 Distribution of mother's occupation for the three sub samples

Mother's Occupation	6	7	8
None	46	40	47
Unskilled	15	18	22
Skilled	4	5	3
Clerical	4	7	3
Business	5	4	0
Administrative	1	1	0
Professional	0	1	1
Any other	2	2	0
Total	77	78	76

Contingency coefficient = .256, non significant

Table 3 7. Details of type of family

Type of family	6 years	7 years	8 years
Nuclear	48	48	57
Joint	20	18	17
Extended	9	14	4

Contingency coefficient = .167, non significant

Table 3 8 Religion-wise details for the three sub samples

Religion	6 years	7 years	8 years
Hindu	69	65	63
Muslim	7	13	11
Christian	1	2	1

Contingency coefficient = .134, non significant

Tools and techniques

Keeping in view the principal objectives of the study and the sample for the main study, a *pilot investigation* was first conducted to assess the cognitive development of 10 boys and girls aged 6-8 years. The objectives of the pilot study were to work out and finalize the assessment battery, the materials, procedures and the exact instructions to be given to the subjects for each of the tests and techniques to be employed.

The results of the pilot study helped to refine the materials and instructions. Based on its findings, the final battery to assess cognitive development was prepared.

This battery consisted of the following tools.

Table 3.9 List of techniques/tests included in the final battery for the child

Personal data sheet for collecting relevant **demographic details**
Knox Cube Imitation Test for assessing ***attention***
Cancellation test for assessing ***concentration***
Digit Span for assessing ***immediate memory***
Mahn's Intelligence Scale for Indian Children (MISIC) - four subtests - viz., *Vocabulary, Comprehension, Arithmetic and Information*, (translated into Kannada at NIMHANS, for use with Kannada medium students), for assessing ***intelligence.***
Piagetian tasks of ***conservation of density, mass, seriation, time judgement, number and arithmetical operations, age and concept formation.***

Personal Data sheet

Based on the requirements of the study, a personal data sheet was drawn up, which elicited relevant information (Refer Appendix 1 for details).

Knox Cube Imitation Test

This test is a simple test, often used of assess attention in children. Attention refers to the ability of the subject to select a particular stimulus from the

environment and process it for further action. This test consists of 5 wooden, one inch, square blocks, all of the same colour, shape and material. Four of the blocks are placed in front of the subject, one inch apart. The following instructions are given to the child, "*I am now going to tap these blocks in a particular order. Watch me carefully, and then do as I did.*" Before every trial, the "*Ready*" signal is given. Then, with the fifth block in the hand, the examiner taps the four blocks on the table in a prescribed manner (Refer Appendix 2 for the schedule of presentation), always starting from the subject's left. There are altogether 12 trials, in increasing order of difficulty. The test is stopped when there are four consecutive failures. The number of correct trials constitutes the subject's score. Norms for this test have been developed for different age groups (Prakash, Rao and Murthy, 1985). Higher the score, greater is the subject's attention capacity.

Cancellation Test

The digit cancellation test is a popular test used to assess concentration. Concentration refers to the ability of the subject to constantly monitor and weed out irrelevant from relevant stimuli, as they occur randomly. This is the ability to focus attention on a particular task for a specified amount of time. This test consists of a sheet on which numbers from 0 - 9 are randomly arranged. The subject is instructed to go on canceling out the number 5, in every line, till he is asked to stop. He is asked to proceed horizontally, without omitting any line. The time limit for the test in one minute. At the end of the time limit, the number of 5s correctly cancelled, the number of 5s not cancelled within the attempted number of lines (omissions) and the number of other digits, other than 5 cancelled (errors) are counted to yield the score of the subject. Norms for the test have been developed for Indian children (Prakash, Rao and Murthy, 1985).

Malin's Intelligence test for Indian Children (MISIC)

This test is the Indian adaptation of the Weschler Intelligence Scale for Children (WISC) adapted by Malin (1971) at Nagpur. Following the rationale of the WISC, this test has 11 subtests, five of which are performance subtests

and the remaining six are verbal subtests The entire battery is time consuming and this would tax and fatigue the young child It was therefore decided that only the verbal subtests would be administered, especially as all the children were school going students English and Kannada translations (done at NIMHANS) were used The six verbal subtests are *Vocabulary, Information, Comprehension, Arithmetic, Analogies and Similarities and Digit Span* The pilot study had revealed that the Analogies and Similarities subtest was difficult for the children to understand, and time consuming Since this battery was just a part of the entire testing procedure and information about concept formation would also be obtained from the Piagetian tasks, it was decided to drop this one subtest from the MISIC, while administering it to this sample of students However, through prorating, it would still be possible to obtain a verbal IQ if required Moreover, the test was included not merely to give us a comprehensive picture of IQ but rather for the specific cognitive abilities that each of the subtests was assessing This test is applicable for children in the age range of 6-15 years The test material is presented in Appendix 3 Details of each of the subtests used and their rationale are presented below

Vocabulary

The vocabulary subtest taps a variety of cognition-related factors, including learning ability, fund of information, richness of ideas, memory, concept formation and language development According to Sattler (1988), this subtest provides an excellent estimate of intellectual ability Performance on this subtest is stable over time and is a useful index of the subject's general mental ability This subtest is the best measure of 'g' in the scale

The vocabulary subtest consists of 40 words arranged in order of increasing difficulty The child is asked to explain orally, the meaning of each word The verbatim responses are recorded and then scored with reference to the key The subtest is discontinued when there are five consecutive failures Items 1 through 6 are scored 2 or 0, and from 7 through 40, they are scored 2, 1, or 0 Criteria and examples of marginal responses are given in the manual The scores for each response are totalled and this constitutes the Vocabulary score

Information

The amount of information children possess may depend on their natural endowment, the extent of their education (both formal and non-formal), and their cultural opportunities and predilections In general, the Information subtest samples the knowledge that average children with average opportunities should be able to acquire through normal home and school experiences The child's responses and comments provide clues about the child's general range of information, alertness to the environment, social or cultural background etc

This subtest contains 30 questions that sample a broad range of general knowledge Included are questions concerning names of objects, dates, historical and geographical facts and other such information The questions are arranged in increasing order of difficulty Each question is read out and acceptable answers are indicated in the manual The subtest is discontinued after five consecutive failures Each item is scored as 1 or 0 The total number of credits is the subject's score on this subtest

Comprehension

This subtest involves understanding given situations and providing answers to specific problems Success depends, in part, on possession of practical information plus an ability to draw on past experiences in reaching solutions The responses may reflect the child's knowledge on conventional standards of behaviour, extensiveness of cultural opportunities and level of development of conscience or moral sense Success suggests that the child has social judgement and a grasp of social conventionality These characteristics imply an ability to use facts in a pertinent, meaningful and emotionally appropriate manner (Sattler, 1988)

This subtest contains 14 questions that deal with problem situations involving knowledge of one's body, interpersonal relations and social mores The test is discontinued after three consecutive failures Scores are graded as 0, 1 and 2, based on the scoring criteria and samples given in the manual The scores are totalled and this is the subject's score on this subtest

Arithmetic

The problems on the Arithmetic subtest require the child to follow verbal directions, concentrate on selected parts of questions and use numerical operations. Children must have knowledge of addition, subtraction, multiplication and division operations. The emphasis of the problem is not so much on mathematical knowledge per se, but on mental computations and concentration. This subtest measures numerical reasoning. It requires the use of noncognitive functions (concentration and attention) in conjunction with cognitive functions (knowledge of numerical operations). Education, interests, fluctuations of attention, and transient emotional reactions influence success on this subtest. According to Stewart & Moely, (1983), information processing strategies as well as mathematical skills may underlie performance on this subtest. These strategies may include rehearsal (in order to remember the information presented) and recognising when an appropriate response has been made (in order to change incorrect patterns or strategies).

This subtest contains 16 problems of which three are presented on cards and the rest are presented orally. Arranged in increasing order of difficulty, many of the problems are similar to those commonly encountered by children. Answers must be given without the use of paper and pencil. This is a timed subtest. The problems are read out and timing starts after stating the problem the first time. Repetitions are at the expense of the subject's timing. The test is discontinued after three consecutive failures. Responses are scored 0 or 1. The subject's score on this subtest is the total score for all the correct responses on this test.

Digit Span

This subtest was used as a measure of short-term auditory memory and attention. The task assesses the child's ability to retain several elements that have no logical relationship to one another. Because auditory information has to be recalled and repeated orally in proper sequence, the task has been called as a sequencing task.

This test has two parts the Digits Forward which contains series ranging in length from three to nine digits, and the Digits Backward which contains series ranging in length from two to eight digits There are two series of digits for each sequence length Digits Forward is administered first followed by Digits Backward.

Digits Forward primarily involves rote learning and memory whereas Digits Backward requires considerably greater transformation of the stimulus input, prior to recall The mental image of the numerical sequence must not only be held longer (usually) than in the Digits Forward sequence, but must also be manipulated before it can be restated Performance on Digits Backward may therefore indicate flexibility, good tolerance for stress, and excellent concentration Digits Backward involves more complex cognitive processing than does digits Forward, and has higher loadings on 'g' than does Digits Forward (Jensen & Osborne, 1979)

Starting with the Digits Forward, the digits are presented to the child, clearly, at the rate of one digit per second The score of the subject is the number of digits in each series correctly recalled Adding up the scores on Digits Forward and Digits Backward yields the score on the digit span subtest Because of differences between the two tasks, it is sometimes useful to consider the two separately Digits Forward appears to involve primarily sequential processing, while Digits Backward appears to involve both planning ability and sequential processing

Piagetian tasks:

Jean Piaget, the famous Swiss Psychologist, one of the most influential thinkers in the field of child development constructed his theory that outlined the cognitive development of children and the mental stages they seem to go through He conceived of intelligence as a form of biological adaptation of the individual to the environment Cognition extends the scope of biological adaptation by allowing the individual to move from the immediate action level to the symbolic level through the process of internalisation Piaget's model of intelligence is a hierarchical one, in which intellectual development is divided into

four major periods, each characterised by stages and substages. Each stage evolves from the preceding one, and none can be skipped in the development of cognition. These four stages of mental ability are the *sensory-motor* stage which extends from birth to around the second year, the *preoperational* period from around 2 – 7 years, the *concrete operations* stage from seven to eleven years and the period of formal *operations* which starts after age 11-12. He described in detail the functioning and development of cognitive capabilities during these stages. The two stages of relevance to this study are the preoperational and concrete operations. During the preoperational stage, Piaget posited that children begin to acquire the ability to perform internal mental activities or operations, as opposed to purely physical operations. The children's thoughts are still closely related to their bodily movements and their perceptions. During the concrete operations stage, children's thinking begins to speed up. Children are able to represent the physical world with images and symbols. Children begin to use numbers. They begin to show the first signs of logical thinking about the physical and concrete world rather than accepting surface appearances. Thus the concept of conservation or the ability of the child to recognize that certain properties of objects (e.g. mass, volume, number) are invariant and do not change despite transformations in the appearance of the objects. This ability begins to emerge at this stage.

Piaget and his colleagues have developed many tests that help characterize a child's mental operations at the different stages. Some of these, which were appropriate for the age group, were selected from Piaget's manual. Piagetian tasks provide insight into the child's thinking processes. The Piagetian tasks used in this study were as follows and they cover the understanding of conservation, logical operations and seriation. These tests are informal tests with approximate age norms.

Concept of Time

This task assesses the child's concept of time, speed/frequency, work and equality.

Problem: To determine whether the duration of an action is evaluated on the basis of external data (e.g. rapidity of an action, its results) or by internal factors such as direct introspection.

Task: To draw strokes neatly (trial 1) and quickly (trial 2) for 15 seconds and then estimate which if any, took longer.

Materials: Sheet of paper, pencil and a stopwatch.

Procedure: The examiner asks the child to draw a number of strokes (lines), working as neatly and carefully as possible for a period of 15 seconds. After 1 minute's rest, the child is asked to draw strokes (or lines) again, but this time as quickly as he can. He is again stopped after 15 seconds and asked, if any, of the two tasks took longer. Reasons for the responses are noted down to facilitate scoring.

Scoring: Level 1 (4-5 years old): All the children think that it takes longer to draw the strokes in Trial 2 because they judge purely by the results of their work (they were able to draw more strokes), and not by any kind of inner feeling.

Level 2: (5-6 years old) 90% say that work done rapidly takes more time than work done slowly (there are more strokes).

Level 3 (6-7 year olds) 80% still believe that quicker the work, the longer it is.

Level 4: (7-8) 50% evaluate duration like the younger ones, while 50% have come to rely on introspective assessments. The latter think that when working slowly, times 'seems' longer than when working rapidly.

Level 5: (10-13) One third of the children react like the younger children, the rest like the more advanced stage of level 4, the expressions and explanations used show that they rely on the impressions obtained during the action itself and therefore take recourse to introspection: 'it seems to me', 'almost' etc.

Concept of Seriation

This test of seriation measures the child's understanding that objects can be put in order according to their size. This task assesses number, ordering relations,

the concept of "in between" and transitivity The Piagetian concepts thus studied are asymmetrical relations, seriation, grouping and reversibility

Problem To study the mutual implication of ordination

Task Arranging 10 sticks according to length and then another 10 in between these, again according to length

Procedure A series of ten small sticks each differing in length from the next by 0 8 cm, coloured in blue, and lettered at the back, such that a correct ordering would spell PSYCHOLOGY, are given to the child who is asked to arrange the sticks in ascending order The child's ordering is noted down in terms of the letters written at the back of the sticks

The child is then given a second set of nine sticks, each differing from those in the first series by approximately 0 4 cm each These are coloured red, and lettered at the back such that a correct ordering would spell EDUCATION The child is given these sticks in a random order, and asked to insert them "in the proper places" within the first series Once again, after the child has finished ordering the second series of sticks, the arrangement made by the child is noted down in terms of the arrangement of the letters printed at the back Observations are also noted down to facilitate scoring

Scoring Level 1 (4 years) The child constructs or arranges small series without internal order In making them, he pays attention only to the top 2 or 3 He cannot evaluate numerically more than two or three sticks The rest of the order is all mixed up

Level 2 (5-6 years) The child reaches the correct seriation after successive trials and rearrangements Beforehand he divides the sticks into small and large He then compare each element with all the others The child however, cannot interpolate the second series into the first

Level 3 (6-7 years) The child can compare and measure, simultaneously taking account of the relations < and > Interpolation is possible

Concept of Number and Arithmetical operations

This conservation task measures the child's understanding that variations in the configurations of one group of objects brings about corresponding changes in the other, such that the number of objects does not change This task assesses equality, number and arithmetical operations The Piagetian concepts covered by this task are equalisation of differences and grouping

Problem To determine whether the child is capable of understanding the identity of a whole throughout various additive compositions of its parts

Task A To give a number of tokens in two unequal groups and ask the child to make the groups same or equal

Task B The tokens are then put together and the child is asked to divide them into two equal parts

Materials Twenty-two tokens, all of the same size, shape and colour

Procedure Task A The child is given the 22 tokens in two groups of 8 and 14 and asked to subtract from one and add to the other to make them equal

Task B After he has done it, the child is presented with all the tokens together and ask them to divide them into two equal groups

Scoring Task A

Level 1 (5-6 years old) The child does not realize that adding to smaller decreases the larger

Level 2 (5-6 years) The child proceeds by reducing the unequal piles to similar figures If elements are left over, they are allocated either token by token or pair by pair The child reaches perfect similitude by trial and error

Level 3 (6-7 years) The child use correspondence as the means of equalization he sets up an equivalence independent of the arrangement of the element

Task B

Level 1 (5 years) The collection is divided without consideration of the individual elements, the child just arranges the piles into 2 groups more or less similar There is no durable equivalence between the two parts

Level 2 (5-6 years) If the two piles form equal figures, the child decides that they are equal, if not, their judgements is one of inequality

Level 3 (7 years) The child divides the tokens one by one, or two by two to establish the two compositions

Concept of Grouping and Classes.

This task assesses concrete representation, logical operations and classes The Piagetian concepts studied here are logical multiplication of relations, quantification and grouping of complementary classes

Problem To investigate whether the singular class is used in the same way as are the other classes in spontaneous classifications Does numerical symmetry have a positive or a negative effect upon the various possible classifications?

Task The child asked to classify or group the shapes into different dimensions

Materials Cardboard pieces that have been cut into different geometric shapes are used There are altogether four large blue squares, four small blue squares, three large blue circles, four small blue squares, one large red circle, one large red square, one small red square, one small red circle Thus the groups can be made in terms of shapes (squares and circles), size (large and small) and colour (blue and red)

Procedure In the first trial, the child is given all the blue pieces and only one large red circle Thus in all 16 pieces are given The child is told to classify these objects into two groups in any way he likes The basis of classification in noted, and then he is asked to re-divide them into two classes, again, using a different criterion Once again the basis of classification is noted The same procedure is followed once again If the child is unable to make a third grouping (since there is only one red), the remaining three red objects (large red square, small red square and small red circle) are added and the child is once again asked to make a new classification

Scoring Level 1 (5-6 years) The child spontaneously groups the objects according to their shape, putting the large red circle with other circles At the

third classification into two collections, the child reverts back to one of the first two classifications

When the extra red elements are added, the child still resists grouping according to colour unless extra elements are added and the number of red equal blue

Level 2 (7-8 years) The child readily groups according to shape and size, but does not succeed in finding the third criterion

When the extra red elements are added, the child succeeds in grouping according to colour

Level 3 (7-8 years) The child succeeds in classifying by colour at the first trial, for others this is not until the second or third trial

Concept of Aging

This task assesses time, ordering and representation of the world More specifically, the child's concept of age is assessed

Problem To study how the disassociation between age and size is made and how the child comes to understand that age depends on date of birth and not on size

Task Pictures of two trees, one with a straight trunk and the other with a thin twisted trunk are shown and the child has to indicate which is older

Materials Two pieces of cardboard are used (Refer Appendix) They are of the same size, and on one is pasted the picture of a tree (15 cm high) with a large straight trunk, on the other there is a picture of another tree (10 cm high) with a thin, twisted trunk

Procedure The examiner asks the child whether one can know which tree is older by merely looking at the picture If the child judges by height, he is then asked if he has ever seen old people who are short etc

Scoring Level 1 (5-8 years) For trees, age is proportional to height Though some children think that a person can be short and old, they do not make the generalization to trees

Level 2 (5-8 years) - child progressively makes the distinction between size and age some children think that the shorter tree never grew up but the idea that age is proportional to size remains strong

Level 3 (7-9 years) - There is a disassociation between the two notions of age and height - child spontaneously appeals to the date that the trees were planted as the sole criterion by which to determine their age

Conservation of matter (Solids)

This conservation task measures the child's understanding that changes in the shape of a solid do not change the quantity of that solid Thus the problem was to study how the child forms the notion of conservation of matter through the transformations that an object is made to undergo

Task Transforming the modelling clay (rolling it flat) and asking whether both have the same amount of clay

Materials Two balls of modelling clay, identical in size, shape weight, colour and texture

Procedure The examiner shows the two balls of modelling clay to the child and asks if both the balls have the same amount of clay If the child says "no" or if there is any doubt, the child is encouraged to make them same After it is ascertained that both are alike, the examiner, in front of the subject, changes the shape of one of them by flattening it out like a chappathi The child is then asked if the two shapes have the same quantity of matter ("is there the same amount of clay in both?") After the child responds, the child is asked to justify his answer and give explanations

Scoring Level 1 (5-7 years) The notion of conservation is lacking Any transformation of one of the balls brings about either an increase or a decrease in the quantity of matter The child fixes his attention on one dimension only (length, height, thickness etc) and therefore feels that one has more clay than the other

Level 2 (6-8 years) The child accepts conservation as long as the deformations remain slight and explains that "it's the same amount as we did not

take away my clay" or "because we can make the same ball again" etc However, when the transformations are too big, the child's attention is directed to the dimension that strikes him the most (goes to level 1)

Level 3 (7-12 years) The conservation of matter appears as necessary to the child, no matter what the transformations, differences are mutually compensated or cancel each other out

The last Piagetian task given assessed

Concept of Density, Volume and Weight

This task assesses density, physical quantities, representation of the world, volume and weight

Problem To investigate to what degree, the compression/expansion pattern is used to explain the difference in density of various substances

Task The subject has to indicate and explain which of the three objects - stone, thermocol and wood - is heaviest and why?

Materials Three objects, a small piece of stone, a little bigger piece of wood, and a large piece of thermocol

Procedure The examiner keeps the three objects on the table and asks the child as to which is the biggest and the lightest of the three The child is also asked the reason for his answer

Scoring Level 1 (5-8 years old) The children are able to predict differences in density when the volumes are equal, when this is not the case, they judge the weight of the body as proportional to its volume They do not succeed in disassociating the quantity of matter from the volume and the volume from the weight When they pick them up, thus becoming aware of facts contrary to their expectations and predictions, they explain these differences by referring to their perceptions " the thermocol is lighter because it is made of thermocol" or "because it is white" etc

Level 2 (7-10 years) The quantity of matter appears proportional to the volume of the bodies to be compared, but the weight no longer depends solely on the apparent volume of the object but also to "what's inside" The child explains the differences in density not by matter or weight but for example by referring to its origin or to their substantial qualities For e g "The stone is heavier because it is made from earth"

Level 3 (8-10 years) The child makes the distinction between apparent quantity of matter and internal quantity objects of equal volume may be more or less "filled in" The weight is proportional to the quantity of matter inside 'there's more stuff inside and that makes it heavy"

Level 4 (10-12 years) The child explains density by the fact that the elements making up the total volume of the object are more or less closely packed

Thus tests for specific cognitive abilities and a general cognitive development measure were included The entire test battery took around an hour to administer Individual testing of the children in the school premises was done, to collect the information Apart from testing the child, the class teacher was also asked to rate the child on a 10-point scale, for overall cognitive development

Along with the battery to assess cognitive development in children, the interview schedules for fathers and mothers, to assess influence of home environment were also drawn up Both the parents (fathers and mothers) were interviewed to determine the effect on home influences on cognitive development Using the **semi structured interview schedule,** information was collected about the demographic details of the family, the material prosperity, crowding, the availability of older models for imitation, the exposure and attitudes to the mass media, the time spent with the child in study and play, the socialization practices, the child rearing practices adopted etc The interview schedule for the mother was more elaborate since generally, in the Indian set up, mothers have better knowledge of a child of this age and have more time to spend with the interviewer The interview schedule is presented in the appendix

The following aspects were therefore studied The interview schedules covered the following subsections:

- *demographic details*,
- *household data* which was assessed using the WHO index (World Bank Report, 1993) This elicited information about the material prosperity of the index child and the family This consisted of questions concerning type of house construction, type of residence, size of the house, availability of electricity, water supply and media, and family transport Thus, the basic amenities available to the individual and material prosperity of the individual were assessed
- *family details* elicited information about the type of family, family size, presence of role models in the house, number of siblings, birth order of the index child, and crowding
- *media* This subsection queried for information about access to media and type Efforts were made to obtain data about story telling, reading habits of the family and the index child, TV watching by the family and the index child and going to movies Details of favourite books, authors, TV programmes, serials, type of programmes watched, amount of time spent watching TV, attitude to television etc were all elicited
- *study* this subsection was concerned with information and attitudes towards school, teachers and homework
- *leisure activities*, this subsection asked questions about the toys and games the index child played, time spent with the child in pleasurable activities like playing, music, talking, story telling, etc
- *future activities* examined the aspirations the parent had for the index child
- The last subsection required that the interviewee rate herself/himself on temperament, frustration tolerance, mood, activity, social

affect/sociability, talkativeness, and interpersonal warmth, traits have been found to be related to home environment

Thus, the interview schedule examined the influence of home environment on the several aspects Table 3.10 gives a summary of the different areas covered in the interview schedule

Table 3.10 Different areas of home influence assessed in the interview schedule

family economic aspects
family social aspects
parental education - mother and father
parental occupation - mother and father
parental attitudes to the target child - mother and father
presence of role models
the nature, kind and amount of stimulation available to the target child in the home
access to media
kind of school - school environment
parental traits as rated by self

General Procedure

The data collection was spread over 6-8 months Schools were first contacted and depending on the inclusion-exclusion criteria decided, children were selected After the assessment of their cognitive development, parents were interviewed, either in the school premises or in their homes, depending on feasibility and convenience All testing and interviewing was done on an individual basis Responses obtained were then scored, tabulated and analyzed in order to satisfy the objectives stated

4

INFLUENCE OF HOME ENVIRONMENT ON COGNITIVE DEVELOPMENT

Analysis of the Results

The data from the test battery was scored according to the procedures laid down in the test manuals, and keyed into the computer using Fox-Pro as the database program. Robiey et al (1995) in their study on comparing ERP correlates of psychometric and Piagetian intelligence measures have reported that there is strong evidence that intelligence comprises different components related to different subsets of cognitive processes, as indexed by different ERP waves. This therefore implies that any one measure of cognitive development would not give the entire picture and as many aspects should be measured to arrive at a wholistic assessment of cognitive development. Therefore several components had been assessed. However, as one composite score was required to assess cognitive development, T scores were calculated for each of the cognitive variables assessed. T scores (Garrett, 1973) are normalized standard scores converted into a distribution of 50 and σ of 10. According to Garrett (1973), T scores have general applicability, are convenient units and they cover a wide range of talent. Besides these advantages, T scores from different tests are comparable and have the same meaning, since reference is always to a standard scale of 100 units based upon the normal probability curve. T scaling forces normality upon the scores of a frequency distribution and "for the distribution of most mental abilities in the population, normality is a reasonable - and is often the only feasible - assumption" (Garrett, 1973, p 318). These T scores for the various tests and subtests were totaled for each individual to yield a composite cognitive development score. This score was used for all further analysis.

To study the nature of cognitive development and to justify the assumption of a composite cognitive development score, the different measures obtained were intercorrelated and a factor analysis was carried out Tables 4 1 gives the intercorrelation matrix for the variables assessed As can be seen, most of the inter-correlations were positive, indicating that all the measures included in this investigation were related to each other and measured different aspects of cognitive ability

To study the factor structure of these different measures, a factor analysis was then carried out

Factor analysis is a one of the multivariate statistical techniques used to identify a relatively small number of factors that can be used to represent relationships among sets of many interrelated variables It thus helps to reduce large amounts of data into smaller, more understandable sets of data Identification of the underlying dimensions or factors greatly simplifies description and understanding of complex phenomena The observed correlations between the variables result from their sharing these factors Thus the goal of factor analysis is to identify the not-so-directly-observable factors based on a set of observable variables Generally, factor analysis proceeds in the following steps

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Table 4.1 Inter-correlation matrix for all cognitive variables assessed

	Arith.	Attn	Age	Comp	Conc	Cpt	DF	DB	Density	Info	Matter	NoA	NoB	Sern	Time	Vocab
Arithmetic	1.00	.28**	.12	.39**	.21**	.14*	.30**	.30**	.08	.44**	.13	-.26**	.24**	.35**	-.05	.42**
Attention		1.00	.16*	.32**	.22**	.28**	.44**	.58**	.25**	.59**	.04	.03	.18**	.27**	-.26**	.41**
Age			1.00	.38**	.45**	.36**	.36**	.31**	.49**	.46**	.51**	.44**	.40**	.44**	.45**	.42**
Comprehension				1.00	.57**	.36**	.53**	.56**	.39**	.63**	.47**	.46**	.50**	.46**	.30**	.66**
Concentration					1.00	.21**	.49**	.37**	.45**	.51**	.45**	.39**	.43**	.42**	.39**	.51**
Concept Formation						1.00	.53**	.41**	.31**	.53**	.34**	.38**	.47**	.47**	.28**	.37**
Digits Forward							1.00	.64**	.30**	.68**	.49**	.38**	.42**	.57**	.35**	.50**
Digits Backward								1.00	.13*	.63**	.33**	.25**	.36**	.51**	.09	.48**
Density									1.00	.36**	.55**	.53**	.45**	.42**	.63**	.41**
Information										1.00	.50**	.47**	.54**	.59**	.29**	.72**
Matter											1.00	.52**	.50**	.43**	.55**	.50**
Number A												1.00	.78**	.38**	.50**	.48**
Number B													1.00	.43**	.40**	.50**
Seriation														1.00	.33**	.48**
Time															1.00	.27**

** $p < .01$

- First, the correlation matrix for all variables is computed
- In the second step, factor extraction - the number of factors necessary to represent the data and the method of calculating them - is computed. In the present study, estimates of the initial factors were obtained from the principal components analysis. In principal components analysis, linear combinations of the observed variables were formed. In order to determine the number of factors that are significant, only factors that had Eigen values greater than 1.00 were included. A glance at table 4.2 reveals that three factors, with eigen values greater than 1.00 accounted for 63.7 or 64% of the variance. Thus a three factor solution seems most sufficient to explain cognitive ability in this group of subjects. In order to identify the factors, the group of variables that have large factor loadings on that factor were identified. Table 4.3 gives the factor pattern matrix so that the variables with high loadings (above 0.50) appear together, small factor loadings have been omitted.
- The third step - rotation, focuses on transforming the factors to make them more interpretable.

Table 4.2 Results of the factor analysis for the cognitive variables

Factor	Eigenvalue	Percent of Variance	Cumulative Percentage
1	7.03478	44.0	44.0
2	2.15787	13.5	57.5
3	1.00556	6.3	63.7

Table 4 3. Rotated factor matrix for the three factors, with their factor loadings

Variables	Factor 1	Factor 2	Factor 3
Conservation of Age	60630		
Concentration	51929		
Conservation of Density	82722		
Conservation of Matter	71253		
Conservation of Number A	72519		
Conservation of Number B	62524		
Conservation of Time	81523		
Attention		68766	
Concept formation		63280	
Digits Backwards		81483	
Digits forward		74895	
Information		71569	
Concept of seriation		59267	
Arithmetic			81631
Vocabulary			53123
Comprehension			50154

The factor structure and loadings reveal that most of the Piagetian tasks, specifically the conservation tasks along with concentration ability all load with factor one, and account for 44% of the variance. This factor could be named as *conservation*. The second factor accounting for 13.5% of the variance had high factor loadings with attention, immediate memory, and concept formation, while factor three, accounting for 6.3% of the variance, had high factor loadings with three of the subtests of Mahi's Intelligence test for children (MISIC). All the abilities tested in this investigation were accounted for in this factor matrix. A correlation matrix between the Piagetian tasks and Mahi's scale yielded a correlation of .9018, which was positive and highly significant revealing that the Piagetian concept of cognitive development and general intelligence as measured

by Wechsler scales are highly inter-related Thus the assumption of including all the measures into a composite cognitive development index was justified

To satisfy the first objective and to determine home influences on cognitive development, multiple regression analysis was carried out Human behaviour is an exceedingly complex affair and the behavioural scientist can ordinarily expect to find a multitude of factors influencing any given action Stated statistically, variation in a given dependent variable is usually a function of concomitant variation in many independent variables, acting simultaneously The technique of multiple regression enables the behavioural scientist to use his knowledge and select scientifically two or more independent variables to predict movements in a single dependent variable with greater probability of success than is possible with the knowledge of a single independent variable (Roscoe, 1975)

Multiple regression analysis is the method for isolating the effects and the magnitude of the effects of more than one independent variable on one dependent variable, using the principles of correlation and regression It provides a simple method of establishing a functional relationship among variables The relationship is expressed in the form of an equation connecting the response or dependent variable 'Y' (here - cognitive development) and more than one independent variable, X_1 X_2 X_p Thus the basic idea in multiple regression analysis is that a number of independent variables are used to predict the dependent variable, the so-called criterion variable The method and calculations are done in a manner to give the 'best' prediction possible, given the correlation among all the variables The results of the calculations tell us how much of the variance in the dependent variable is accounted for, by the 'best' linear combination of the dependent variables (Kerlinger, 1964)

In the present investigation, the responses obtained from the interviews of both parents were coded to yield data on home and school influences All information was converted to numerical data Qualitative or demographic variables, which are discontinuous, cannot be directly used in regression analysis However these qualitative variables are very useful as explanatory variables in regression analysis and consequently cannot be ignored These were therefore

represented by *indicator or dummy* variables These dummy variables take on only two values, usually one or zero The two values signify that the observation belongs in one of two possible categories The numerical value of the dummy variables are not intended to reflect a quantitative ordering of the categories but only serve to identify class or group membership (Chatterjee and Price, 1977) When creating dummy variables for multicategory nominal variables like religion, one dummy variable was created for each category of the variable Thus for Hindus, Muslims and Christians, - the dummy variable 'Hindu' would have the value Hindu (coded 1) and non-Hindu (coded 0), Muslims and Christians would be included in the non-Hindu category of the variable Hindu Thus the number of dummy variables for a single multicategory nominal variables would always be $k - 1$ (Zeller and Carmines, 1978) The variables studied are presented in table 4 4

Several multiple regression analyses were carried out The first multiple regression analysis helped to determine the influence of all factors - demographic, parental, school, media and self on cognitive development The composite cognitive development score was used as the dependent variable 67 predictor variables were used to help explain the variance in cognitive development The multiple regression equation involving all the predictor variables is presented in the Appendix After fitting the linear model to the given body of data, it was desirable to evaluate or assess the adequacy of fit of the model to the observed data The index most widely used for this purpose is the *multiple correlation coefficient*, R. This "goodness of fit' index can be viewed as a measure of the strength of the linear relationship between the least-square linear composite of the independent variables and the observed dependent variable An often used statistic is the squared correlation coefficient or R^2 which is referred to as the *coefficient of determination* This R^2 can be interpreted as the proportion of total variability in the dependent variable which is explained by, or accounted for in the regression equation by the predictor variables The value of R^2 is thus used as a summary measure to judge the fit of the linear model to the given body of data

Table 4 4 Home influences assessed through the interview

Demographic/Family Variables

- Age
- Sex - Male/female
- Religion - Hindu/Muslim/Christian/Others
- Family type - Nuclear/Joint/Extended
- Household data
- Order of birth
- Presence of siblings as role models
- Languages known read/speak/write

Paternal Variables

- Father's Age
- Education
- Occupation
- Media access newspapers, books, TV, attitudes
- Talkativeness
- Frustration tolerance
- Interpersonal warmth
- Mood
- Sociability
- Tension
- Activity level
- Amount of time spent with index child in leisure time activities

Maternal Variables

- Education
- Occupation
- Media access -newspapers, books, watching TV, attitude to watching TV
- Talkativeness
- Frustration tolerance
- Interpersonal warmth

Table 4 4 Continued

Maternal Variables (continued)

- Mood
- Sociability
- Talkativeness
- Temperament
- Number of languages known
- Activity level
- Amount of time spent with index child in leisure time activities

Media Variables

- Access to media
- Newspapers - languages, number and people in the family who read it
- Magazines
- Books
- Radio
- Cinema
- Television-frequency, attitudes, favourite programmes, whether monitored
- Stories

School Variables

- Medium of instruction
- Number of boys in the class
- Number of girls in the class
- Child's attitude to school
- Amount of home work given
- Whether any schedule is followed in studying
- Whether child goes for tuition
- Whether any one supervises the child's work
- Teacher's evaluation of the child

The present analysis yielded a *multiple correlation coefficient*, R of 0.809989. The R^2 was therefore 0.81, indicating that the 67 predictor variables studied in this investigation accounted for 81% of the variance in cognitive development in the index child.

Parsimony is one of the cardinal rules of science. Thus an attempt was made to arrive at an adequate description of the observed phenomena in terms of as few meaningful variables as possible. This economy in description has two advantages:

- It enables us to isolate the most important variables and
- It provides us with a simpler description of the process studied, thereby making it easier to understand the process.

To do this, stepwise regression analysis was carried out. Stepwise regression is one of the methods of selecting independent variables for the regression equation. At each step, an independent variable, not in the equation, which has the smallest probability of F, is entered, provided that probability is sufficiently small. Variables already in the regression equation are removed if their probability of F becomes significantly large. The method terminates when there are no more variables eligible for inclusion or removal. This method yielded nine variables, which accounted for 69% of the variance in cognitive development. Table 4.5 gives the results.

These results reveal that the age of the child, *paternal variables* of education and tension, *maternal variables* of talkativeness, *media variables* of watching TV and reading books, the *school variables* of medium of instruction, number of girls in the class, and teacher's evaluation, all explain the variance in cognitive development of the child.

Table 4 5 Results of the stepwise multiple regression for all home and school influences assessed

Variable	B	SE B	Beta	T	Sig T
Age	48 16	4 16	557	11.561	0000
Father's education	4 46	2 20	143	2 025	0448
Father's tension	-6 81	2 27	- 163	-2 997	0032
Watching T V	35 32	16 07	.107	2 198	0296
Medium of instruction	-39 28	11 68	- 270	-3 364	0010
Reading books	31 33	8 71	217	3 598	.0004
Talkativeness of mother	5 35	2 45	106	2 182	0307
Number of girls in the class	1 76	0 67	141	2 636	0093
Teacher's evaluation	6 18	1 62	186	3.807	0002
(Constant)	381 84	38 58	9 898		0000

Further multiple regressions were done to find out the effect of each of the subset of variables When paternal variables were regressed, the multiple linear regression yielded an R^2 of 34% The beta values and coefficients for the entire equation are presented in Appendix The stepwise regression equation yielded the importance of only two paternal variables that accounted for the variance in cognitive development viz , father's education and reading the newspaper These two accounted for 26% of the variance The equation that resulted is presented in table 4 6

Table 4 6 Stepwise multiple regression results for paternal variables

Variable	B	SE B	Beta	T	Sig T
Father's education	11.328	2 58	370	4 39	0000
Reading newspapers	25 601	11 02	195917	2 324	0213
(Constant)	720.480	11 23	64 129		.0000

Maternal variables were found to account for 28% of the variance in cognitive development of the child (R^2 = 0.275). The multiple regression equation along with beta values and coefficients are presented in the appendix. The stepwise regression equation yielded an R^2 of 22% and only one variable was found to be of importance viz., maternal education. The regression equation results are presented in table 4.7.

Table 4.7 Stepwise multiple regression results for maternal variables

Variable	B	SE B	Beta	T	Sig T
Mother's education	15.06	2.147	.471	7.014	.0000
(Constant)	729.16	10.033	72.678		.0000

All the 16 media variables included in the present investigation were found to account for 34% of the variance in cognitive development (R^2 = 0.33989), and the results are presented in the appendix. Stepwise regression however revealed that only two variables, viz., presence of a reading habit in the family and specifically in the index child accounted for 25% of the variance in cognitive development. Thus the results seem to underlie the importance of reading in developing cognitive abilities in the child. Moreover, watching TV, which seems to be the favourite past time of most children nowadays, does not in any way improve the cognitive abilities of the child. The regression equation in presented in table 4.8. These two variables were found to account for 25% of the variance.

Table 4.8 Stepwise multiple regression results for media variables

Variable	B	SE B	Beta	T	Sig T
Reading habit in the family	32.20	11.69	.224	2.754	.0066
Child's reading habit	47.93	11.47	.340	4.178	.0000
(Constant)	64.89	6.22	122.891		.0000

The next set of regression equations calculated were for the school variables. Ten different variables were used as predictors and yielded an R^2 of 0.3667. The

regression equation is presented in the appendix. Calculation of the stepwise regression equation revealed that five variables accounted for an R^2 of 0.34. The equation is presented in table 4.9.

Table 4.9 Stepwise multiple regression results for school variables

Variable	B	SE B	Beta	T	Sig T
Number of boys in the class	-1.54	760	-.130	-2.022	0448
Medium of instruction	-57.27	9.473	-.415	-6.046	0000
Schedule followed in studying	52.18	11.982	309	4.354	0000
Tuition	24.80	10.16	-.166	-2.441	0157
Teacher's evaluation	6.86	2.08	.21	3.299	0012
(Constant)	830.46	27.79	29.883		0000

The last set of regression equations were for demographic/family variables. The results reveal that the twelve predictor variables used helped account for 46% of the variance ($R^2 = 0.46029$) and the details of the regression analysis are presented in the appendix. Stepwise regression calculations revealed that four variables viz., age, presence of a younger brother, material prosperity of the family and order of birth helped to explain 44% of the variance in cognitive development. The regression equation which resulted is presented in table 4.10.

Table 4.10 Stepwise multiple regression results for demographic/family variables

Variable	B	SE B	Beta	T	Sig T
Age	45.034	4.848	.546	9.289	0000
Presence of younger brother	-18.885	8.691	-.127	-2.173	0312
Material prosperity	3.779	865	262	4.368	0000
Order of birth	-9.227	2.551	-.218	-3.616	0004
(Constant)	427.365	38.527	11.092		0000

Putting all these results together, we see that nine variables are most important in predicting cognitive development of children, and these include paternal variables, maternal variables, the media and school When these are regressed separately, we find that education of parents, both father and mother contribute to higher cognitive development in the child This underlines the importance of education, not only for the individual, but also for the future generations Parents, who are educated, tend to be more aware of their surroundings, have a wider vocabulary base, are more informed, provide more cognitive stimulation to their children and tend to realize the importance of education This seems to reflect in better cognitive abilities of their children However genetic confounding may also be present, because more intelligent parents tend to have more intelligent children When the different subsets of variables were regressed, the most important maternal variable was found to be maternal education This finding has important implications It seems to imply that if we educate the parents, we educate the family, specifically, educate the mother and the cognitive skills of the child will improve Thus more impetus will have to be given to educate the girl child, so that she, as the future mother would guarantee better cognitive abilities of her children This may be because mother child interactions are generally more, and therefore educated mothers are able to give quality stimulation to their children Studies of family influence have also stressed the importance that mothers play in the cognitive development of the child As Baker and Nelson (1984) have reported, a mature, educated speaker provides conversation which presents the child with material that is just at the leading edge of his or her competence, and what holds good for language development, holds good for cognitive development as a whole

Interestingly enough, the regression equation for media variables, revealed that reading habits of the family and the index child were the most important variables contributing to cognitive abilities of the child This result seems to be an off shoot of education Education provides the basis for the 3Rs reading, writing and arithmetic Very often formal education is the only route to master reading skills The television as a medium of information did not seem to influence cognitive abilities Thus the results seem to imply that the print

medium is a better source for development of cognitive skills, and therefore the reading habit should be inculcated in all children. Qualitative analysis had revealed that most children, irrespective of class or religion, spend most of their time watching the television, if not in their own homes, in the homes of their neighbours. Time spent on reading books, comics, magazines was found to be abysmally small. Considering the cost effectiveness of the print media compared to the audiovisual medium of the television, this finding has strong policy implications. For young children at least, education and development of cognitive skills should be pursued through books which is a more active pursuit, rather than through TV educational programmes which are more passive in process. Moreover, the responses had revealed that even when watching TV, the programmes that were most popularly watched were film-based programmes which do not lend themselves to the development of cognitive skills in younger children.

School variables were also found to contribute significantly to the development of cognitive skills in young children. Specifically, the number of children in the class, the medium of instruction (whether English/Kannada), whether the child followed any schedule when studying, whether the child went for tuition and the teacher's evaluation of the child were found to be contributory variables. Thus the results imply that smaller number of children in the class, ensuring more individual attention to the child, English medium of instruction, some routine in the child's study habits, sending the child for tuition and a positive evaluation of the child by the teacher, all seem to lead to better cognitive development in the child. Looking at the interview data, the one fact that emerges is that. Thus to sum up, the different variables used in this investigation did help to account for a major part of the variance in cognitive development in 6 to 8 year olds. Education of parents was found to be one of the major factors resulting in a higher level of cognitive skills in the index child. Reading was also a positive factor. The type of school the child attended seemed to influence the level of cognitive development. Though all these factors may be intricately linked, the findings have major policy implications.

However when interpreting these findings and in dealing with the influence of environmental conditions, in the absence of experimental manipulation of the environmental variables involved, any conclusions we draw, must as Patterson (1986) stated in his study of aggressive behaviour in children, "rest on the sinking sands of correlational analyses" (p. 435). Cause and effect relationships cannot be stated firmly. However, any attempt to change some of the factors and hopefully bring about a consequent increase in cognitive skills would be a worthwhile endeavor.

5
INTERVENTION

This research study had an applied aspect to it as well. One of the main aims of this research study was to develop an intervention package to increase the cognitive ability scores of children who lacked the cognitive skills requisite for their age. The study had revealed that students in government schools (which were already lacking in infrastructure and had high number of students) were lower in their cognitive development, compared to their age counterparts. Hence it did not seem feasible to plan an intervention programme which would involve teachers. Moreover, other studies (Padmini 1983) have developed packages for school based interventions. Further, the analysis of the results had revealed that home does influence cognitive development. Therefore, based on review of past research and the present results, it was decided to plan an intervention programme that would be aimed at parents, specifically mothers. This part of the research used a pre-post research design.

Sampling technique

The first phase involved the determination of the sample for the intervention programme. To do this, the composite cognitive development score was tabulated and frequency distributions were arrived at for each age group. Cognitive development at the lower ages is age linked. Six-, seven- and eight-year-olds perform differently on the cognitive tests as their abilities are still developing. Therefore, one common distribution would be unfair for the six-year olds, who would score lower. Moreover, the one way ANOVA, of the composite cognitive score across age, was highly significant as is evident from table 5.1, revealing highly significant age differences in cognitive ability.

Table 5.1 Differences in composite cognitive development score across age

Age	Mean	S.D.	F ratio
6 years	754	58	36 04**
7 years	811	54	
8 years	832	60	

Quartiles were therefore calculated for each of the frequency distributions in order to arrive at those children whose cognitive development scores were in the last quartile (i e 25th percentile and below) for their respective age groups The frequency distributions are presented in the Appendix

These students were identified, so that the intervention programme could be given to them When selecting the students, several criteria were kept in mind

- The intervention programme envisaged was a group based one, to be carried out in the school premises Therefore children studying in the same school were preferred, as it would be more convenient for their mothers to attend and commuting to the venue would not be problematic
- There had be a big enough hall, where mothers and children could sit together comfortably
- The management of the school, the principal and teachers had to co-operate in this venture

Based on these criteria, 15 students scoring low on cognitive development, belonging to the same school were selected for the intervention Another 10 students, who also scored low, formed the control group, and these were not given any intervention It was assumed that a comparison of the scores of the experimental and control group would further validate the efficacy of the intervention

Method

Theoretical rationale

The intervention envisaged the use of the mediational approach to intervention as postulated by Klein (1996) in her model the **Mediational Intervention for Sensitizing Caregivers** (MISC). This model aims at understanding specific components or "criteria" within adult-child interaction affecting *flexibility* or *plasticity* of mind in young children. This approach helps to identify a series of factors that may turn adult - child interactions into an enriching learning experience for the child, using patterns that are present within the existing childrearing practices. The MISC is primarily concerned with affecting children's need systems and creating dispositions that are essential for future learning, through *focussing, affecting, expanding and rewarding*.

According to this approach, preparing young children for future development must include provisions for creating in them *flexibility of mind*, a predisposition for learning from new experiences that they may encounter within their traditional cultural setting or confront as changes introduced by "modernity" (Klein, 1996, p. 3). This flexibility of mind can be defined by the needs or "appetites" they acquire for modes of perception, elaboration and expression that will enable them to learn from new experiences and become more sensitive and socially adjusted. Very often, the children's basic physical needs are met without thinking of the need to "mediate", to focus and expand their experience of the world. Lacking such mediation, they are starved for an enriching interaction with a sensitive, human caregiver. This mental type of starvation, which, if not dealt with, may lead to a tremendous waste of human potential that, is almost as painful and tragic to humanity as the loss of lives. The MISC approach helps to recognise those factors in interactions with children that promote flexibility of mind and it fits in the cultural background of the family. It does not depend upon the import of external methods, tools or ideas, because it operates inside the existing child rearing practices.

Through mediation, the complex world is organised for the child, channelled by a network of cultural transmission into a world in which things have meaning, importance and relevance to future as well as past experiences. Recently it has

become clear that the most basic factors affecting cognitive development depend upon the kind and amount of human interaction to which the child is exposed Carew (1980) demonstrated that experiences involving an infant's interaction with another person, especially experiences in which the adult reacted to the child correlated with measures of development earlier, more highly, and more consistently as compared to intellectual experiences that were created and experienced by the child himself More specifically, mothers of those children defined as competent infants were found to be spending more time teaching the infants, facilitating their activities and stimulating them intellectually White, Kaban and Attanucci (1979) suggested that environments that teach children to gain adults' attention, to please adults, to learn from looking and listening, are environments that promote cognitive development Numerous studies have repeatedly demonstrated significant relations between various criteria of development and maternal behaviour such as attentiveness, warmth, responsiveness and nonrestrictiveness

The theory of Mediated Learning Experience (MLE) is part of the theoretical framework of *cognitive modifiability* (Feuerstein, 1979), based on the conceptualisation of intelligence as the capacity of the organism to use previous experiences for future learning MLE is the process of learning that occurs when another person serves as a mediator between the child or learner and the environment, preparing and reinterpreting the stimuli from the environment so that they become more meaningful and relevant Mediation is an active process The mediator acts upon the stimulus by selecting, accentuating, focusing, framing, providing meaning and locating the stimulus in time and space The mediation enables the individual to benefit from experience, it actually prepares him to learn

The overall objective of the Mediational Intervention for sensitizing caregivers (MISC) is to help and sensitize parents (or other caregivers) so that they can relate to their children in a way that will enhance their child's cognitive, socio-emotional, and moral development,

This approach, advocated by Klein (1996) identifies the following criteria as universal characteristics of an interaction between as adult and child, turning that interaction into a mediated learning experience for the child They are

- Focusing - Intentionality and Reciprocity
- Expanding and going beyond the immediate (Transcendence)
- Mediation of meaning and excitement
- Rewarding - mediating feelings of competence
- Regulating of behaviour - helping the child to plan before acting

Focusing - Intentionality and Reciprocity

The Mediated Learning Experience is not accidental, it is a conscious intentional act It is a dynamic process in which the mediator (usually the mother) attempts a series of actions to reach the objective of the mediation The mother, through adjustments of her behaviour, selects that part of the environment to which she wishes to focus the child's attention, and chooses and regulates the modes of the child's response

Here, an attempt is made by the mediator to focus the child's attention on something in the child's surroundings There must therefore be a clear indication of the adult's intentionality to mediate and of the child's reciprocity Reciprocity is achieved when the mediator succeeds in catching the child's attention so that the child responds vocally, verbally, or non verbally to the adult's behaviour Such an interaction creates a "joint intention, an openness, a readiness to perceive changes and respond on the part of both parent and child" (Klein, 1996, p 11) Intentionality affects the basic processes of arousal

A behaviour that is considered intentional is considered reciprocal when the child in the interaction responds vocally, verbally or non verbally to an adult's directive behaviour The intention to mediate between the environment and the child has several basic components viz, regulating the state of arousal of the child, calling his/her attention to stimuli and affecting his/her response

Expanding and going beyond the immediate (transcendence)

In Mediated Learning Experience, expanding is seen whenever the mediator tries to extend the child's understanding of what is in front of him/her by explaining, comparing, or adding new experiences that may not be necessary for the ongoing interaction. At a higher level, one explains to the child why certain things happen, and tries to compare it with something the child has already experienced before. Thus the goal of the interaction is expanding and going beyond the immediate experience, from its immediate precedent and consequences to others that are remote in time and space. A mediated experience is therefore not required to just satisfy immediate needs. Because of going beyond the immediate, structural changes take place which in turn help the child to anticipate for, search for and imbibe a need for information beyond the immediate. According to Klein (1996), the conceptualization of expansion is different from reinforcement.

Mediation of Meaning and Excitement

An adult's behaviour that expresses verbal or non verbal appreciation or affect in relation to objects, animals, people, concepts, and values endows these stimuli with feeling and meaning, so that they "stand out" in the child's experiences. This helps to make the experience more distinctive and meaningful. This affective, value-oriented connotation can be transmitted to the child through the mediated learning experience.

Rewarding - Mediating Feelings of Competence

Mediation of feelings of competence is seen when adults express satisfaction with the child's behavior and explain why they are satisfied. Through this mediation, children acquire a sense of mastery, a feeling that they are competent, capable and successful, which contributes to their willingness to explore and meet new challenges. Thus curiosity and active exploration, an imperative for cognitive stimulation, are encouraged.

This mediation focuses not only on the end product, viz., success or failure, but also on the process. By focussing on the process that led to the success and on the mental process that preceded it, children are able to use their experiences

to construct a realistic picture of their success and of the specific components of behaviour that led to it

Regulating of behaviour - Helping the child to plan before acting

Here, the mediator brings to the child's awareness, the possibility of "thinking" before doing, of planning steps of behaviour toward attaining a goal The mediator, by modeling, demonstrating, or scheduling objects or events in time and space, introduces a pattern or plan of activities, thus regulating the pace and reducing the child's impulsiveness in perception, elaboration, and expression Regulation of behaviour thus entails matching the characteristics of the task to be performed with the child's capacities and interests, as well as organizing and sequencing steps towards its success This helps in developing goal-directed action and problem solving

Thus, in general, mediated learning, according to Klein (1996), prepares the individual to seek experiences of new learning It instills new needs in the child, i e , the need to go beyond the satisfaction of the body's needs, the need to have one's experiences interpreted, related to the past and future sequences, and embedded in a meaningful frame of reference that is relevant to the individual

Research has revealed that through mediational intervention, children stand a better chance of becoming more intelligent and sensitive, ready to benefit from cultural transmission and new experiences

Along with the MISC, attention-enhancing cognitive skills were also taught Attempts were made to increase the attention span of the child since attention is the gateway for all further information processing This was done with the help of simple tasks such as colouring, scanning of letters, and a variation of the Knox cube These techniques have been used successfully by Vahalli (1993) with hyperkinetic boys in a school setting Research in India (Asha, 1998) on preschool children has vindicated the usefulness of the MISC in fostering cognitive and social development

Procedure

The intervention programme targeted the mothers of these children who were low on cognitive development It was planned as a group session, with 7-8

parents in each group. These mothers attended the sessions along with the index child. The sessions were carried out in the school premises, in a large room, free of all furniture. Though it had been intended that we meet the mothers for about ten sessions of one hour each, it was not found to be feasible, mainly because all these children belonged to the lower middle SES and many of the mothers were working to supplement the family income. Thus though highly motivated and cooperative, they were unable to come for ten days, as it would cut into their earning capacity. The programme was therefore slightly modified, such that three afternoon sessions of three hours each, were scheduled in one week. Each group met on alternate days. During these sessions, mothers were told the importance of all the components of the MISC model with examples from everyday life. Story sessions were used to elaborate the meanings. Adult-child interactions were also initiated, examined in the light of the MISC model and modified wherever necessary. Cognitive skills were also taught to the index child.

After this one-week of intensive interaction, the children continued to meet the researchers for another week. During these sessions the research personnel continued with the activities of story telling, expanding of meanings, colouring and initiating feelings of competence, a variation of the Knox Cube test to improve attention, visual scanning (cancellation of letters) to improve concentration etc. Thus in all, the intervention lasted for about 20 hours per child.

Details of the different activities undertaken are given below.

Colouring activity

Colouring was the first attentional task undertaken. It also provided for mother-child interaction, where aspects of the MISC model were put into practice, under the supervision of the researcher. Blank sheets of paper were given to the mother, and the mother was asked to draw *rangoli* patterns on these sheets of paper. The child was then asked to colour the pattern drawn. While colouring, the mothers were encouraged to mediate feelings of competence, by praising specific acts such as choice of colours, keeping within the pattern etc.

Story Telling

The intention of this activity was to teach the mothers about expanding and going beyond the immediate (transcending). In this task, each mother, one by one, narrated a story, as she would naturally tell her child. The other mothers, also listened and gave suggestions for transcending the immediate. Mediation of meaning and excitement, as well as telling the children the importance of planning their behaviour was all taught through these stories. The children were later asked questions to ensure that they had paid attention to the subtle and minute details of the story.

Visual scanning of letters

This was again a mother-child interaction. Since many of the mothers knew only the vernacular language (Kannada), Kannada newspapers were used. The child was asked to read any news item in the paper and cancel out a particular alphabet. As this is a concentration task, the rationale of this activity was to increase the ability of the child to concentrate. Mothers were asked to check the activities of the child, and mediate feelings of competence, and regulation of behaviour.

After one week with the mothers, the activities and mediated learning continued for the children. The activities of colouring, story telling and visual scanning were repeated, with slight variations. For the colouring, the children were provided with papers with pictures drawn on them, and they were asked to colour them. The research personnel mediated feelings of competence, regulation of behaviour and pro social skills of sharing colour pencils with their group mates. In the story telling session, each child was asked to narrate a story, with meaning and excitement (verbal and non verbal) and the other children had to try and transcend the immediate and explain the meaning for the different aspects of the story. An additional task was also added during these sessions, to help improve attentional skills.

Attentional skills

In this variation of the Knox cube test, children were grouped into pairs One child of the pair would tap the cubes in any sequence This would be the stimulus that then had to be repeated by the other child of the pair If correct, the child was rewarded and feelings of competence were mediated The children would then swap roles and the activity would continue The sequences became more complex as the activity progressed

Given below in a summary of the activities undertaken during the intervention programme

Table 5 2 Summary of the session timetable

- A 20 minute theoretical discussion of one of the facets of the MISC programme, using examples from everyday life
- Question and answer session where doubts were clarified
- Colouring activity
- A brief break of 10 minutes
- A 20 minute theoretical discussion of any one of the facets of the MISC programme, using examples from everyday life
- Story telling
- A brief break of 10 minutes where refreshments (biscuits and drinks) were given
- Visual Scanning of letters
- Discussion

At the end of the intervention programme, a post intervention assessment was done to evaluate the efficacy of the intervention The child was once again tested on the following tests

- Knox cube Imitation test for attention
- Letter cancellation for assessing concentration
- Digits Forward and Digits Backward for assessing immediate memory
- Piagetian tasks

The control group (children who did not undergo the intervention) was also given the same assessment tasks as the experimental group. The responses on these tests were scored and subjected to experimental verification.

Analysis of results:

Two sets of t tests were calculated to verify the efficacy of the intervention programme. One set, using the *two independent samples* technique, compared the scores of the experimental and control group on the composite cognitive development score, arrived at in the same manner as in the first phase. Two series of t tests were calculated, one to prove that the two groups were homogenous prior to intervention, and the second, post intervention, to check the efficacy of the programme. Table 5.3 gives the results.

Table 5.3 Comparison on pre-intervention assessment scores-Experimental and control groups

Variable	Experimental Group		Control group		T ratio
	Mean	S.D.	Mean	S.D.	
Cognitive Development	537.80	24.69	547.56	17.02	0.99
Attention	2.40	1.17	2.11	0.78	0.62
Concentration	8.90	2.64	6.67	2.12	2.02
Digits Forward	3.60	0.70	3.44	0.53	0.54
Digits Backward	0.00	0.00	0.22	0.67	1.06
Density	1.50	0.53	1.56	0.53	0.23
Matter	0.90	0.32	1.00	0.00	0.95
Time	1.70	0.95	2.44	1.01	1.65
Number-A	1.30	0.68	1.11	0.33	0.76
Number-B	1.20	0.63	1.11	0.33	0.38
Age	1.30	0.48	1.44	0.53	0.62
Concept Formation	0.60	0.52	1.00	0.00	2.32*
Seriation	0.90	0.57	1.22	0.67	1.14

Table 5 4 Post intervention assessment - Experimental vs control groups

Variable	Experimental group		Control Group		T ratio
	Mean	S.D.	Mean	S.D.	
Cognitive Development	596 90	46 49	559 00	20 74	2 33*
Attention	5 1	1 60	2 78	0 67	4 05**
Concentration	11 70	3 02	7 33	2 00	3 67**
Digits Forward	3 80	0 42	3 44	0 53	1 63
Digits Backward	1 30	0 95	0 44	0 88	2 03
Density	1 60	0 52	1 67	0 50	0 29
Matter	1 90	0 74	1 00	0 00	3 65**
Time	1 90	0 88	1 67	0 50	0 90
Number-A	1 30	0 68	1 33	0 50	0 12
Number-B	1 30	0 68	1 22	0 44	0 29
Age	1 60	0 52	1 67	0 50	0 29
Concept Formation	0 80	0 42	1 00	0 00	1 42
Seriation	1 60	1 08	1 56	0 73	1 00

* $p < .05$, ** $p < .01$

Analyzing all these results together, we find that all the pre-intervention comparisons are non-significant, (except for the Piagetian task of concept formation where the control group does better) These results imply that prior to intervention both the experimental and control groups are more or less similar on the relevant cognitive assessments Table 5 4 which gives the results after the intervention however reveals that on several of the variables, viz , composite cognitive development score, attention, concentration and the Piagetian task of conservation of matter, the two groups are significantly different, with the experimental group, in all cases doing better These results therefore suggest that the intervention programme of mediated learning and cognitive skills training

initiated has brought about a change in the experimental group. This therefore implies that the programme was effective.

To validate these findings, *repeated measures t tests* were also computed for the experimental and control groups separately, pre and post intervention. It was expected that the experimental group would show significant changes in the pre-post intervention comparison, while the control group would not have changed significantly on the assessment measures. Such findings would then help us confirm that the changes in the experimental group could be attributed to the efficacy of the intervention, and not to the passage of time. Table 5.5 gives the results of this series of t tests.

Table 5.5. Pre and post intervention assessment scores (experimental group)

Variable	Post-intervention		Pre-intervention		T ratio
	Mean	S.D.	Mean	S.D	
Cognitive Development	596.90	46.49	537.50	24.69	5.77**
Attention	5.10	1.60	2.40	1.174	7.36*
Concentration	11.70	3.02	8.90	2.64	5.25**
Digits Forward	3.80	0.42	3.60	0.70	1.00
DigitsBackward	1.30	0.95	0.0	0.0	4.33**
Density	1.60	0.52	1.50	0.53	0.43
Matter	1.90	0.74	0.90	0.32	6.71**
Time	1.90	0.88	1.70	0.95	1.50
Number-A	1.30	0.68	1.30	0.68	-----
Number-B	1.30	0.68	1.20	0.63	1.00
Age	1.60	0.52	1.30	0.48	1.76
Concept Formation	0.80	0.42	0.60	0.52	1.50
Seriation	1.60	1.08	0.90	0.57	2.69*

* $p < .05$; ** $p < .01$

Table 5 6: Pre-post intervention assessment scores - Control group

Variable	Post-intervention		Pre-intervention		T ratio
	Mean	S D.	Mean	S D.	
Cognitive Development	559 0	20 94	547 56	17 02	1 85
Attention	2 78	0 67	2 11	0 78	2 00
Concentration	7 33	2 0	6 67	2 12	0 97
Digits Forward	3 44	0.53	3 44	0 53	-----
Digits Backward	0 44	0 88	0 22	0 68	0 55
Density	1 67	0 50	1 56	0 53	1 00
Matter	1 00	0 00	1 00	0 00	-----
Time	1 67	0 50	2 45	1 01	1 94
Number-A	1 33	0 50	1 11	0 33	1 51
Number-B	1 22	0 44	1 11	0 33	1 00
Age	1 67	0 50	1 44	0 53	1 00
Concept Formation	1 00	0 00	1 00	0 00	--------
Seriation	1 56	0 73	1 22	0 67	2 00

These results further corroborate the findings The pre-post comparison of the experimental group reveals that on six of the assessment measures, viz , composite cognitive development score, attention, concentration, immediate memory (digits backward), and the Piagetian tasks of conservation of matter and seriation, there are statistically significant differences In all cases, the group does better after having undergone the intervention programme On the other hand, the pre post intervention comparison of the control group shows no changes at all This suggests that the measures are stable and reiterates the finding that the intervention programme was successful in bringing about a change in the cognitive development score of the experimental group

These results are in keeping with those reported when other intervention programmes have been used Parush and Hahn-Markowitz (1997) examined the long term effects of an early prevention program on mother's knowledge, attitudes and practices with regard to their children's development The prevention program focused on increasing the mother's sensitivity to her children's needs and her awareness of the importance of her role in early development 55 mothers and their infants received approximately 5 hours of intervention once every 8 weeks, during the infant's first year of life Subject's knowledge of their child's sensory-motor and language abilities and their belief in their ability to influence their child's development were measured, one and a half to two years after the completion of the prevention programme Results revealed that the intervention group was higher than the control group suggesting that the prevention program helped mothers acquire greater knowledge and more appropriate attitudes and practices about child development

In another study, Ricksen-Wahaven, Meij, Hubbard and Zevalkink (1996), surveyed 37 Surinam-Dutch lower-class families with a one year old who participated in "Imtapje" a parent focused home based intervention programme The intervention was devised to improve quality of parental support to the child on four behavioural dimensions Results revealed that at the end of the intervention, parents of the intervention group were more supportive than the comparable control group and their children scored significantly higher on the Bayley's Mental Scale of Infant Development than children in the control group

6

SUMMARY AND CONCLUSIONS

This research was conducted with two objectives in mind

(1) it aimed at determining the effect of environmental influences on cognitive development of children in the age group of 6-8 years

(2) It also intended to investigate the effects of an intervention programme intended to foster cognitive development in these children. Thus the study had an applied aspect as well

This group was selected because most studies which have had an intervention facet have been conducted on preschool children, under the assumption that the brain is still maturing and this age would be most appropriate to initiate corrections and reconstructions. However, this study had at its base, the assumption that development is life long and while the first three years of life are critical, the primary school years are just as significant in the cognitive development of the child.

For this group, specifically two environments – home and school were studied, though primary emphasis was given to the home. This had theoretical and practical considerations. Theoretically, for a primary school child, the home is still a major source for interactions. Furthermore, the intervention envisaged improving mother-child interactions qualitatively using Klein's (1996) Mediational Intervention for sensitizing caregivers (MISC) approach. This approach was adopted keeping in mind the fact that teachers in primary schools are an over-burdened group and involving them in an intervention may not have met with too much success. Moreover, the intervention had to be continued over a period of time. These considerations prompted the use of mothers as the 'intervention-aides' in this study.

To meet the first objective of this study, 240 children in the age group of 6-8, with an equal number of boys and girls, were administered a battery of psychological tests to assess specific cognitive abilities as well as their level of cognitive development. Their parents (both fathers and mothers) were also interviewed to assess the effects of home influences on cognitive development. A personal data sheet elicited school details. Using these responses as predictor variables and the composite cognitive score as the dependent variable, stepwise regressions were computed to determine the influence of environmental variables on cognitive development.

The results obtained indicate

- Cognitive ability is a multidimensional concept. All the measures used in this study were positively intercorrelated with each other, indicating that they all measured different aspects of cognitive ability.
- Factor analysis revealed that three factors, which accounted for 67% of the variance, had eigen values above 1.00. All the measures used in this study were accounted for in the factor matrix. Thus arriving at a composite cognitive development score using the scores on all the various subtests, was justified in this study.
- When all the 67 variables were used in the step-wise regression analysis, the results revealed that nine variables accounted for 69% of the variance. These were age of the child, paternal variables of education and tension, maternal variable of talkativeness, media variables of watching TV and reading books, school variables of medium of instruction, number of girls in the class, and the teacher's evaluation of the child. This finding reiterates the fact that cognitive development is influenced by personal, parental, school and media influences. All work in combination to determine cognition.
- When separate step-wise regressions were computed for subsets of variables, the findings reveal that the two paternal variables which emerged as significant were educational level of the father and his reading habit.

- The only maternal variable that was most significant was again, level of education of the mother
- The subset of variables included under "media" accounted for both the print and audio-visual media The results were remarkably in favour of the print media Reading habits of the index child and parents appeared to have the strongest impact on cognitive development, in this age group of children Conversely, television and cinema as means for educational instruction and cognitive development played very insignificant role

- In terms of 'school and study' variables, five variables viz , number of boys in the class, the medium of instruction, the schedule followed in studying, taking of tuition and the teacher's evaluation all contributed significantly to cognitive development in the index child The results revealed that lower the number of boys in class, greater was the cognitive development of the index child Moreover, Kannada, the local language, as the medium of instruction seemed to go along with lower cognitive development This result is a complex one, because a one-to-one relationship between medium of instruction and cognitive variable cannot be postulated As mentioned, Kannada medium schools (which are mainly government schools) have larger number of children in the class, and invariably children who go to these schools belong to the lower and lower middle SES, and are first generation learners Their parents (specifically mothers) are generally not educated As a result they tend to send their children for tuition, as they are not able to cope with the homework allotted, and have learned the value of study habits and a regular schedule for studying, in their children The results therefore seem to imply that in general, government schools with their poor infrastructure seem to be failing in imparting quality education to their students, resulting in lower cognitive skills in their wards This has important policy implications So much of our scarce economic resources are being spent on imparting primary education, but the results seem to be dismal Microscopic evaluation of the reasons for this failure need to be done, and done most urgently, if

quality of education in our government schools has to serve the purpose for which it was intended

- Age, presence of a younger brother, material prosperity of the family and order of birth of the index child were the four demographic variables that helped explain significantly, the variance in cognitive development. While 'age' is an understandable and expected predictor at this stage of development, and SES or material prosperity has been known to influence cognitive development, order of birth and presence of a younger brother are more perplexing. The results seem to imply that elder children have higher cognitive strengths (a result that has been corroborated by other researchers) while presence of a younger brother has a deleterious effect on the cognitive development of the index child who is the older sibling. While these variables may themselves be negatively related, the fact that 'presence of a younger sister' has no effect on the cognitive development of the index child, needs further investigation
- With reference to the intervention programme initiated, the results were extremely positive. It therefore underlines the possibility of involving mothers as "intervention aides" or "intervention agents" whose motivation and interest could be tapped in improving the cognitive capacities of their wards. Since the intervention did not require any elaborate infrastructure or equipment, and in-fact was culturally tied with the mother's education and background, such interventions can lessen the burden on primary school teachers. With increase in cognitive development and augmented motivation, children will be in better position to absorb what is going on in the classroom, leading to better academic performance and resulting in higher self-esteem and heightened confidence. The mother-child dyads will also be a continued source of interaction. However, follow-up studies of maintenance of intervention benefits will be required to substantiate all these claims, and the lack of a follow-up study is one of the limitations of the study

7
POLICY IMPLICATIONS AND SUGGESTIONS

This study has generated many educational and research findings that have implications for public policy

Cognitive Development and parental variables

The study has reiterated the role of the home environment on the development of cognition The importance of education, especially maternal education is the most striking feature that seems to emerge from this study The results seem to imply that if we lay emphasis on educating the female child today, we will be sowing the seeds for a better equipped next generation This is because an educated mother seems to be a better provider of quality stimulation to her child Thus the motto seems to be "educate the girl child and you educate a full family"

Cognitive Development and media variables

The results have emphasized the importance of the reading habit to foster cognitive development Reading as a habit, both in the index child and both the parents, was found to be one of the strongest predictors of cognitive development The study also showed up the lack of importance of the audio-visual medium of the television in this regard These results may be in response to the type of educational curriculum that we follow the academic pursuit of the 3 Rs However, the finding has strong policy implications Though the TV is not an important source of cognitive stimulation for a young child, probably because of its passive nature, yet most children, across all strata, spend most of

their time watching TV. The policy makers instead of spending huge amounts of money in creating TV educational programmes should take greater efforts to inculcate the habit of reading, from a very young age, and in this regard, books should be made more affordable, and well-equipped libraries should be mandatory in all schools. Audio-visual TV educational programmes could be targeted to the older adolescent and young adult, and along with Internet facilities and computer and TV monitors, schools, especially primary schools should be supplied with quality books. This may be a more cost-effective way of spreading primary education and reaping its benefits.

Cognitive Development and the School

The results have also underscored the important role that school plays in developing cognitive skills, thus once again stressing the importance of education, in one and all. Lack of education leads not only to illiteracy, but seems to impair cognitive skills as well. A good school with adequate infrastructure, less crowding in classrooms, a sex ratio favouring girls seem to be some of the pointers towards a good education and higher cognitive development.

In conclusion, this study seems to pinpoint some of the major predictors of home and school environment that play a role in the promotion of cognitive development in primary school children. Home intervention has also emerged as one possible strategy that is cost-effective and could be used with much success, especially in a developing country such as India where economic resources are scarce and at a premium. The best of cognitive skills to meet the demands of the "new millennium and its challenges" is the birthright of every child, and it should be the mandate for all interested, be it parents, educators, policy makers or the government that no effort should be spared to foster cognitive development in children – the wealth of any nation.

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APPENDIX

A. Interview schedule for mothers

Name of child
Sex Age
Name of Mother
Age Religion
Education
Occupation
Income
Mother tongue
Languages spoken at home (or known to mother)
Type of family 1 Nuclear 2 Joint 3 Extended
Birth order of subject Eldest, Middle, Only, Twin
House Address

I. Household data

1 House construction walls
Mud Wood Stone Brick Other

2 Type of House House Apartment Any other

3 House ownership Owned Rented

4 No of rooms (inc living rooms, bedrooms, kitchen exc toilet, bathrooms, storeroom

5 Water supply
1 well shared with other households
2 tap shared with other households
3 own well 4 own tap

6 Toilet
1 no facilities
2 toilet with other households
3 toilet used only by this household

7 Electricity
1 No Supply 2 Supplied

8 How do you usually cook/heat food?
1 Wood 2 Kerosene/coal 3 Gas

9 What transport do you own? (give details)
1 None 2 Cycle 3 Motorised cycle (Luna,etc) 4 Motor bike 5 Car

10 Family size Who all live in this household (over the last 3 months)
1 Parents 2 Brothers & Sisters 3 Grandparents 4 Other children under 16 years (incl cousins) 5 Other adults (over 16 years) 6 How many of the adults over the age of 60 years 7 Any other - servants etc

11 Number, Names, sex, age of siblings including this child (in chronological order)

II. Access to media

1 None	2 NewsPapers & Magazines
3 Radio	4 TV
5 Cable	6 VCR/VCP

2 Which newspapers do you read (which language)

Who all read them in your family?

Which magazines do you read?

Who else reads these magazines?

Which magazines or comics does your child read?

Do you buy or borrow them

Which books do you read books and in which language?

Do you buy or borrow them

How many books do you read? 1) One a month 2) One a fortnight 3) One a week 4) One a day

Do you read out stories to your child? Yes/No

If yes, how often?

Which stories does your child like?

Do you tell stories to your child?

If yes, when and how often?

Does anyone else tell or read out stories to your child? Father/Grandparent/ Uncle/Aunt/ Sibling/ Other

Which story books does your child read? and from where?

Does your child listen to the radio?

If yes, which is the favourite programme?

Does your child watch TV?

If yes, which is/are the favourite progamme/s?

Does he/she watch TV everyday? and for how long?

Does anyone monitor the amount that he/she watches?

Does anyone sit with the child when he/she is watching TV?

Does your child watch video cassettes? Yes/No

Do you buy or borrow these cassettes?

Who chooses them?

How often does he/she watch cassettes?

Which are his/her favourites and in which language?

III. Study habits

Does your child like going to school?

Is there a lot of homework given?

Is there any schedule for the child to do homework? (immediately after school, early morning etc)

Who helps the child with the homework?
Do you have any difficulty in making the child do the homework? (explain)
Does he go for tuition? Yes/No
If yes, for which subjects and how often?
Does the teacher have any complaints about your child?

Do you have any complaints about the teacher or school?

IV Leisure Activities

What toys/games does your child like to play?

Where does your child play and with whom?
Describe in detail, a typical evening for your child (after he/she gets back from school)
What does your child do during holidays?

On an average, do you get any time to spend with your child in play Talking etc (not in homework or in looking after the child) Yes/No

If yes, how much time do you get to spend with the child per day/per week

What do you and your child do together (music, playing etc)

V Future Aspiration
What do you want your child to be when he/she grows up?

VI Self Ratings

1	Maternal temperament Tension	(Not at all)	1	2	3	4	5	6	7	(Very tense)
2	Frustration tolerance	(High)	1	2	3	4	5	6	7	(Low)
3	Mood	(Happy)	1	2	3	4	5	6	7	(Sad)
4	Activity	(Very active)	1	2	3	4	5	6	7	(Lethargic)
5	Maternal social affect Sociability	(Very sociable)	1	2	3	4	5	6	7	(Very unsociable)
6	Talkativeness	(Very talkative)	1	2	3	4	5	6	7	(Not at all talkative)
7	Interpersonal Warmth	(high)	1	2	3	4	5	6	7	(Low)

B. Interview schedule for fathers

Name of child
Sex Age
Name of father
Age
Education
Occupation
Total Income
Languages known

II Media

Access to media - None/ Newspapers/ Magazines/ Radio/ TV/ Cable/ VCR/
Do you read the newspaper? Yes/No
If yes, which newspapers do you read regularly?
Do you read magazines? Yes/No
If yes, which magazines do you read?
Do you read books? Yes/No
If yes, on an average, how may books do you read One a month/ one a fortnight/ one a week/ one a day
Do you watch TV regularly? Yes/No
If yes, which is your favourite programme
Do you think watching TV has interfered with your child's other activities (for eg, reading, studying, playing outside etc)
How do you feel about your child watching TV (attitude to the child watching TV)
Very good - good - OK - Bad - Very bad
Do you get any time to spend with your child in play, talking etc (not in homework or in looking after the child)? Yes/No
If yes, how much time do you get to spend with the child per day/week
If yes, what do you and your child do together?

IV Future Aspiration

What do you want your child to do when he/she grows up? (work/occupation)

V Self Ratings

1	Paternal temperament Tension	(Not at all)	1 2 3 4 5 6 7 (Very tense)
2	Frustration tolerance	(High)	1 2 3 4 5 6 7 (Low)
3	Mood	(Happy)	1 2 3 4 5 6 7 (Sad)
4	Activity	(Very active)	1 2 3 4 5 6 7 (Lethargic)
5	Paternal social affect Sociability	(Very sociable)	1 2 3 4 5 6 7 (Very unsociable)
6	Talkativeness	(Very talkative)	1 2 3 4 5 6 7 (Not at all talkative)
7	Interpersonal Warmth	(high)	1 2 3 4 5 6 7 (Low)

C. Frequency Distribution of composite cognitive development score for the different age groups

6 years		7 years		8 years	
Class interval	f	Class interval	f	Class interval	f
626-650	1	701-725	6	676-700	2
651-675	6	726-750	4	701-725	1
676-700	7	751-775	14	726-750	4
701-725	15	776-800	9	751-775	6
726-750	12	801-825	14	776-800	7
751-775	12	826-850	13	801-825	15
776-800	9	851-875	11	826-850	17
801-825	8	876-900	5	851-875	11
826-850	5	901-925	4	876-900	5
851-875	4			901-925	7
876-900	1			926-950	2
				951-975	2
				976-1000	1

D1. Age-wise frequency distribution of composite cognitive development scores - AGEGROUP 6

Value	Freq	%	Cum%	Value	Freq	%	Cum%	Value	Freq	%	Cum%
643	1	1	1	720	1	1	35	782	1	1	73
657	2	3	4	722	1	1	36	790	1	1	74
668	1	1	5	724	1	1	38	791	1	1	75
669	1	1	6	728	1	1	39	795	1	1	77
672	1	1	8	729	1	1	40	802	1	1	78
674	1	1	9	730	1	1	42	807	1	1	79
688	2	3	12	732	1	1	43	810	1	1	81
694	1	1	1	740	3	4	47	813	1	1	82
696	2	3	16	742	2	3	49	815	1	1	83
698	1	1	17	743	1	1	51	821	2	3	86
699	1	1	18	744	1	1	52	822	1	1	87
702	1	1	19	756	1	1	53	828	1	1	88
704	2	3	22	758	1	1	55	836	1	1	90
709	1	1	23	759	2	3	57	839	1	1	91
711	1	1	25	761	2	3	60	841	1	1	92
712	1	1	26	764	1	1	61	844	1	1	94
714	1	1	27	767	1	1	62	862	1	1	95
715	1	1	29	770	1	1	64	865	1	1	96
716	2	3	31	774	1	1	65	867	1	1	97
717	1	1	32	780	3	4	69	868	1	1	99
719	1	1	34	781	2	3	71	876	1	1	100

Mean 753 766 Median 743 000 Std dev 57 475

D2. Age-wise frequency distribution of composite cognitive development scores – Age Group - 7 years

Value	Freq	%	Cum%	Value	Freq.	%	Cum%	Value	Freq	%	Cum%
712	1	1	1	777	1	1	31	844	1	1	70
713	1	1	3	779	2	3	34	848	2	3	73
717	1	1	4	780	1	1	35	850	2	3	75
720	1	1	5	790	2	3	38	852	1	1	76
722	1	1	6	793	1	1	39	853	1	1	78
725	1	1	8	799	2	3	41	855	2	3	80
728	1	1	9	803	1	1	43	861	1	1	81
730	1	1	10	805	1	1	44	862	1	1	83
736	1	1	11	809	2	3	46	863	1	1	84
743	1	1	13	810	3	4	50	866	2	3	86
751	1	1	14	813	1	1	51	871	1	1	88
754	2	3	16	814	1	1	52	875	1	1	89
759	1	1	18	815	1	1	54	879	1	1	90
762	1	1	19	820	1	1	55	880	1	1	91
763	1	1	20	821	2	3	58	882	1	1	93
764	1	1	21	823	1	1	59	886	1	1	94
765	1	1	23	830	2	3	61	890	1	1	95
766	1	1	24	835	2	3	64	903	1	1	96
770	2	3	26	837	1	1	65	920	1	1	98
771	1	1	28	840	1	1	66	921	1	1	99
773	1	1	29	841	1	1	68	925	1	1	100
774	1	1	30	843	1	1	69				
Mean	811 338			Median	811 500			Std dev	53.506		

D3. Age-wise frequency distribution of composite cognitive development scores – Age Group 8

Value	Freq	%	Cum%	Value	Freq	%	Cum%	Value	Freq	%	Cum%
690	3	4	4	813	2	3	41	858	1	1	77
691	1	1	5	816	3	4	45	865	1	1	78
698	1	1	6	819	1	1	46	868	1	1	79
720	1	1	7	822	2	3	49	870	2	3	82
735	1	1	9	824	2	3	51	874	2	3	85
749	2	3	11	826	1	1	53	883	1	1	86
754	1	1	12	827	2	3	55	896	2	3	88
761	1	1	13	828	2	3	58	902	1	1	90
768	2	3	16	829	2	3	60	903	1	1	91
775	1	1	17	830	2	3	63	905	1	1	92
781	2	3	20	832	2	3	65	910	1	1	94
793	2	3	23	837	1	1	66	912	1	1	95
797	2	3	25	841	2	3	69	916	1	1	96
807	2	3	28	844	2	3	71	926	1	1	97
808	2	3	30	845	1	1	73	958	1	1	99
810	2	3	33	848	1	1	74	987	1	1	100
811	3	4	36	850	1	1	75				
812	2	3	39	851	1	1	76				

Mean 629 359 Median 811 500 Std dev 363 242

E1. Multiple Regression equations

Composite cognitive development – Dependent Variable

All other variables - Predictor variables

Multiple R 89949

R Square 80909

Variable	B	SE B	Beta	T	Sig T
Age	53 331018	6 419060	617323	8 308	0000
Christianity	-48 411638	68 502065	- 079442	- 707	4817
F's activity	- 4 674990	4 519131	- 085685	-1 034	3039
F's age	- 2 317699	1 913116	- 174904	-1 211	2291
F's reading books	1 567776	13 223573	009850	119	9059
Presence of Elder brother	17 003631	14 849944	120067	1 145	2555
Presence of Elder sister	16 223654	14 585869	.112886	1 112	2692
Type of family	1 893288	6 033483	019996	314	7545
Presence of younger brother	-14 644479	10 947361	- 095518	- 1 338	1846
Presence of younger sister	- 3 786606	10 471878	- 025016	- 362	7186
F's education	489412	3 748279	015684	131	8964
F's frustration tolerance	2 890381	3 661691	065977	789	4322
F's interpersonal Warmth	- 7 026701	5 329134	- 129348	-1 319	1909
F's reading-Magazines	- 332621	10.165933	- 002387	- 033	9740
F's mood	- 2 776436	5 462532	- 046941	- 508	6126
F's reading – Newspapers	283510	15.380691	001966	018	9853
F's Occupation	4 749186	4 043605	099434	1 174	2436
F's Sociability	8 997472	4 551865	.175332	1 977	0514
F's Talkativeness	2 535830	4 051034	052505	626	5331
F's tension	-5 781701	3 628905	- 138196	-1 593	1149
F's time spent With child	-20 429194	13 584674	- 140548	-1 504	1364
F's watching TV	-21 146132	13 779709	- 122601	-1 535	1287
F's attitude to TV	- 802979	5 605816	- 011615	- 143	8864
F's attitude to TV – interference	- 056281	4 548169	-9 870E-04	- 012	9902
Household Score	404195	1 495251	027552	270	7876
Hindu	-21 916276	58 938416	- 096824	- 372	7110
Leisure time	17 820071	12 560629	091911	1 419	1597
Languages –read	- 9 028518	10 780869	- 095900	- 837	4047
Lanuages-speak	-10 011118	8 996215	-.105078	-1 113	2690
Languages-write	7 384670	14 176464	075982	521	6038
M's activity	4 518277	4 174753	085810	1 082	2823
M's age	1 305077	1 760800	101268	741	4607
Access to media	-8 837621	5 415807	- 146620	-1 632	1065
M's reading books	12 151219	12 008298	083246	1 012	.3145
Child – cinema	5 133804	7 737915	046696	663	5089

Variable	B	SE B	Beta	T	Sig T
Child – radio	12 193171	9 561980	086953	1 275	2058
Child-reading Books	-17 900060	15 933966	- 097004	-1 123	2645
Child watch TV	51 017520	31 709479	153972	1 609	1114
TV interfere	2 972438	6 382987	048478	466	6427
TV monitored	-4 519190	10 603029	- 032228	- 426	6711
Watches TV alone	-9 579339	11 822926	- 056192	- 810	4201
Medium of Instruction	-68 517141	24 127009	- 471383	-2 840	0057
Stories read out to child	31 038730	13 025070	215204	2 383	0195
Stories told to child	9 086910	7 081511	084766	1 283	2030
M watches TV	-7 157943	15 003592	- 036248	- 459	6476
M's attitude –TV	3 964200	6 871998	053391	577	5656
No of hrs of watching TV/week	-3 994249	5 158071	- 085759	- 774	4409
M's education	4 468250	3 912081	137759	1 142	2567
M's frustration tolerance	-3 689043	4 352420	- 069938	- 848	3991
M's interpersonal warmth	5 430928	5 036359	092771	1 078	2840
No of languages known to M	-4 357785	4 810949	- 072321	- 906	3677
M's mood	2 965343	5 822351	048765	509	6119
M's ocupation	290822	3 484178	005618	083	9337
M's sociability	- 740802	5 578381	- 011694	- 133	8947
M's talkativeness	4 372635	3 811743	086662	1 147	2546
M's temperament	- 317431	4 235523	- 006150	- 075	9404
Muslim	-52 558979	58 379407	- 211617	- 900	3706
No of boys in the class	154961	887064	012626	175	8617
No of girls in the class	1 230016	1 051811	098538	1 169	2456
Order of birth	-4 203176	5 685896	- 096386	- 739	4619
Sex	2 039400	9 287577	015866	220	8267
Supervision of Homework	- 700876	2 400405	- 024706	- 292	7710
Child likes school	48 418431	25 620314	125711	1 890	0623
School schedule	20 003126	13 772606	118655	1 452	1502
Tution	8 514074	14 497592	054760	587	5586
Schedule for Homework	-3 477630	5 561121	- 054312	- 625	5335
Teacher's Evaluation	6 315925	2 054925	189774	3 074	0029
(Constant)	406 034030	83 400683		4 868	0000

E2 - PATERNAL VARIABLES ON COMPOSITE COGNITIVE DEVELOPMENT SCORE

Multiple R 57853
R Square 33470

Variable	B	SE B	Beta	T	Sig T
Activity	3 793001	4 463823	.075777	850	.3968
Age	2 455548	1 047396	187612	2 344	.0204
Reading books	9 374076	12 414734	059540	755	4514
Education	5 075338	3 728169	165832	1 361	1755
Frustration tolerance	-1 884081	3 315624	- 045198	- 568	5707
Interpersonal Warmth	-5 792477	4 490607	- 109368	-1 290	1991
Reading Magazines	10 763087	10 829382	080019	.994	3219
Mood	-7 980104	5 765737	- 144910	-1 384	1684
Reading Newspapers	24 154931	12 027375	184845	2 009	0463
Occupation	5 686265	4.330784	123765	1 313	1912
Sociablity	4 993576	4 565880	.103396	1.094	2759
Talkativeness	757179	3 694145	.016070	205	8379
Tension	-3 911749	3 618556	- 096369	-1 081	2814
Time spent with child	-6 509447	12 366695	- 046123	- 526	.5994
TV watching	-6.661531	12 551324	-.040350	- 531	5964
Attitude to TV watching	- 209439	5 384455	- 003123	- 039	9690
Interference of TV-attitude	- 439694	4 289606	- 007950	-.103	.9185
(Constant)	677 402435	41 428353		16 351	0000

E3 - MATERNAL VARIABLES ON COMPOSITE COGNITIVE DEVELOPMENT SCORE

Multiple R 52429
R Square 27488

Variable	B	SE B	Beta	T	Sig T
Activity	-.743975	4.217969	- 014706	- 176	8602
AGE	2.030273	908439	165597	2 235	0268
Watching TV	12.414698	12 805396	068313	969	3338
Attitude to TV	5 159375	5 137651	071900	1 004	3168
Education	15.315962	2 412093	478488	6 350	0000
Frustration tolerance	-3.378636	4 160100	- 065886	- 812	4179
Interpersonal warmth	-1.932227	5 000215	- 032791	-.386	6997
Languages known	5.580067	4 557962	- 095293	-1.224	2226
Mood	-4.641204	5 238274	- 077701	- 886	3769
Occupation	-3.393503	3.773534	- 066484	- 899	3698
Sociability	3.376035	5 174293	054752	.652	5150
Talkativeness	4.011979	3 526322	084873	1 138	2569
Temperament	-.391465	4.047631	- 007887	-.097	.9231
(Constant)	663.368780	37 067165		17 896	.0000

E4 - MEDIA VARIABLES ON COMPOSITE COGNITIVE DEVELOPMENT SCORE

Multiple R 58300
R Square 33989

Variable	B	SE B	Beta	T	Sig T
Access-media	921422	4 897846	- 049773	- 596	.5518
Read books	25 198895	12 657792	175600	1 991	0484
Child - cinema	343816	7 987953	003188	.043	9657
Child - radio	8 885010	9 727334	064561	913	3626
Child books	7 394861	15 151795	041275	.488	.6263
Child - TV	75 710579	28 290330	227205	2 676	0083
M's attitude to TV - interfere	- 6.8314	4 971587	- 011205	- 134	8933
TV monitored	19 105407	11 246862	139454	1 699	0915
TV - alone	-9 130477	12 636302	- 054202	- 723	4711
Read stories	24 668074	13 859335	175217	1 780	0772
Tell stories	9 517160	8 137916	090152	1 169	2442
M watch TV	9 294581	14 536604	047843	639	5236
M's attitude-TV	6 911464	6 121288	098151	1 129	2608
No of hrs of TV/week	-11 255296	4 092936	- 245491	-2.750	0067
F's attitude-TV	-3.546980	6 140956	- 051894	- 578	5644
F's attitude to TV interference	3 219479	4 830465	057462	666	5062
(Constant)	711 165313	33 615110		21 156	0000

E5 - SCHOOL VARIABLES ON COMPOSITE COGNITIVE DEVELOPEMENT SCORE

Multiple R 60522
R Square 36629

Variable	B	SE B	Beta	T	Sig T
No of boys	-2 002097	793018	- 170134	-2 525	0126
No of girls	1 332809	877898	113883	1 518	.1309
Medium of Instruction	-56 924395	11 098089	- 412256	-5 129	0000
Home work Supervised	175669	2 090832	006598	084	9331
Likes school	30 565152	25 277588	077131	1 209	.22840
Study schedule	44 157362	12 884308	261467	3 427	0008
Tuition	-23 826275	11 936151	- 159826	-1 996	0476
Amount of Home work	4 413096	5 004278	069624	882	3792
Difficulty in getting HW done	24 669920	15 729880	.106588	1 568	.1188
Teacher's Evaluation	8 325987	2 140367	.261831	3 890	.0001
(Constant)	773 170974	39 177983		19 735	0000

E6 - DEMOGRAPHIC VARIABLES ON COMPOSITE COGNITIVE DEVELOPMENT SCORE

Multiple R .67845
R Square .46029

Variable	B	SE B	Beta	T	Sig T
Age	45 836106	5 067586	555614	9 045	0000
Christianity	-52 837392	65 025296	- 084233	- 813	4177
Presence of Elder brother	-2 604543	11 781379	- 019372	- 221	8253
Presence of Elder sister	-7 035771	11 570128	- 050903	- 608	5440
Type of family	1 369586	5 684668	- 014683	- 241	8099
Presence of Younger brother	-20 642090	9 075144	- 139704	-2 275	0243
Presence of Younger sister	-16 910860	8 613900	- 118157	-1 963	0513
Household score	3 559536	907571	247589	3 922	0001
Hindu	11 096469	52 634703	- 049274	-.211	8333
Muslim	-25 219828	54 262950	- 102595	- 465	6427
Order of birth	-7 183040	4 695833	- 169753	-1 530	1281
Sex	6 983709	7 204064	058201	.969	3338
(Constant)	436 284107	66 302454		6 580	.0000

F – LIST OF TABLES *(page numbers in brackets)*